ENGINEERING AND MINING JOURNAL

A McGRAW HILL PUBLICATION

FEBRUARY 1951

FOUNDED 1866

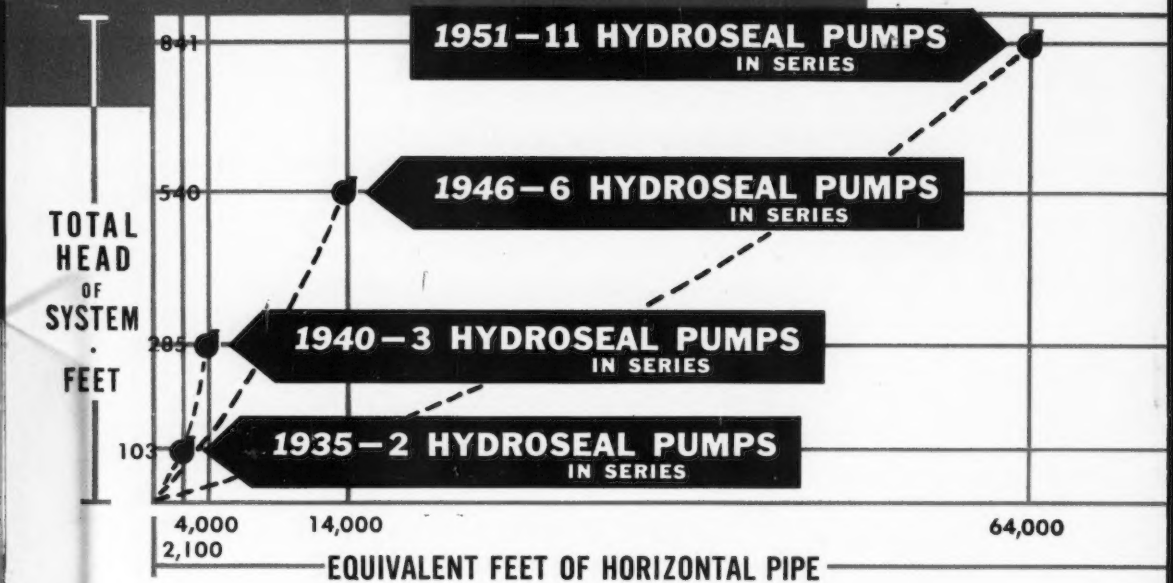
82ND ANNUAL SURVEY AND OUTLOOK NUMBER

Prepare Now to Meet the Biggest Demands Ever Made on Mining

SEE PAGE 71

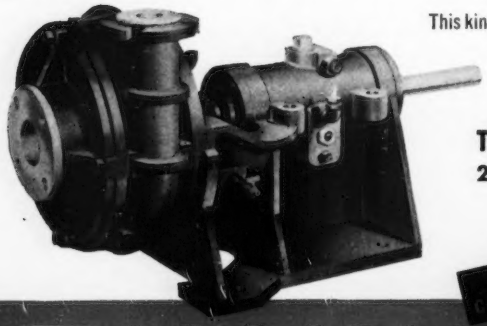
Chart of Pumping Progress

MORE PUMPS...*LESS* COST!



This chart tells you why Hydroseals are getting bigger jobs to do . . . why they're taking the place of more costly and less efficient solids-handling equipment. As you can see, long-distance abrasives pumping has grown steadily since 1935, and today the Hydroseal system of transportation is saving more power, maintenance, and installation costs than ever before. Note these specific advantages:

- **Your pipeline is the shortest distance between two points—there's no waste motion.**
- **You don't need expensive bridges to cross rivers, roadways, etc.**
- **Only a narrow right-of-way is required.**
- **It's a one-way transportation system—that means no empty return trips.**
- **Maximum pumping efficiency, with minimum power and maintenance.**



This kind of flexibility and economy is putting more and more Hydroseals to work where men are moving slurries, sand, rock, and other abrasives. Ask us what they can do for you.

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SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

HYDROSEAL PACKLESS AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD

Convert set-up time into drilling time

with the **NEW**

DJB-2 boom jumbo

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BOOM JUMBO

will drill out a round

IN ONE-THIRD LESS TIME

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With this compact, air-powered Boom Jumbo, there's no more wrestling with heavy arms and machines every time you move the drill for a new hole. At the touch of a lever, an I-R air motor raises or lowers the boom to any desired position in a matter of seconds. Lateral movement is as easy as swinging a door—yet is rigidly locked in position by a single-bolt tapered-joint locking device. Universal ceiling jacks are easily and quickly placed, regardless of ceiling height or contour. (Hydraulic Jack available upon request.)

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The DJB-2 Boom Jumbo is available as a complete, car-mounted unit, or the booms can be furnished separately for installation on single- or multiple-unit rigs.

The illustrated long-lived 48-inch-feed aluminum shells are ideal for use with Ingersoll-Rand Carset Jackbits. Longer feeds are provided for places where they can be utilized.

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The BFG man recommended the B. F. Goodrich cord conveyor belt. Length of service and tonnages have already doubled that given by ordinary belts, and the BFG cord belt is still in service.

Resists acid effects — Each lengthwise cord in the B. F. Goodrich cord belt is completely surrounded by rubber — no cross threads tie them together. With each cord — twisted tighter than ordinary yarn — sealed in rubber, cover cuts admit acid to only a few cords. No absorbing or spreading through the rest of the belt.

Resists cuts, gouges—With parallel cords in "live" rubber, under impact the rubber distorts temporarily; distributes and absorbs shocks that would damage a stiff, unyielding carcass, gives 2 to 6 times greater impact resistance. This impact cushion resists cuts, gouges. A *Transcord Breaker* floated above and across the cord section helps cushion impact, keeps cover from stretching beyond elastic limits. Provides better adhesion between cover and carcass.

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The material you haul may be large and heavy and drop onto belts with crashing blows. Or it may be fine, small but sharp and piercing. In either case, you can cut hauling costs with a B. F. Goodrich cord belt. Your local BFG distributor can begin by supplying you with full data and estimates. Give him a call, or write: *The B. F. Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

Beltroads BY **B.F.Goodrich**

ENGINEERING AND MINING JOURNAL

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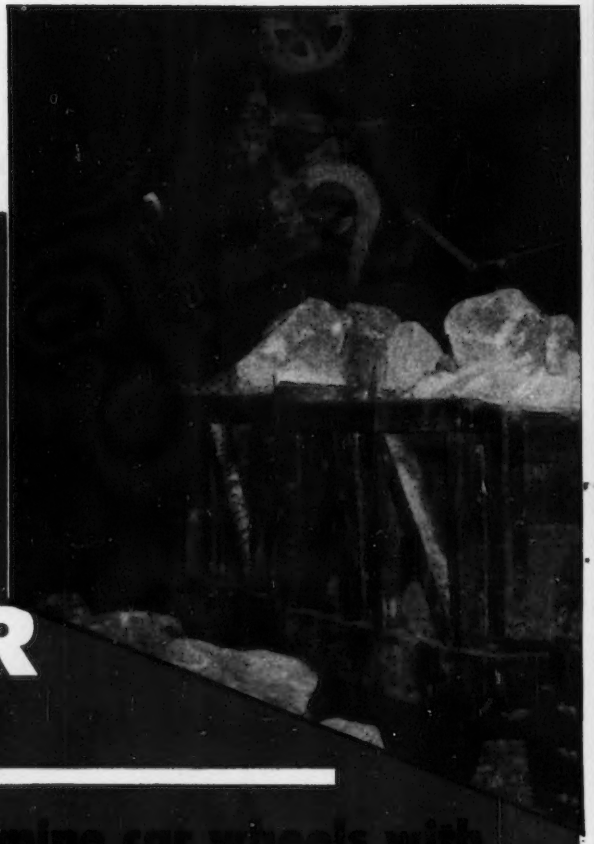

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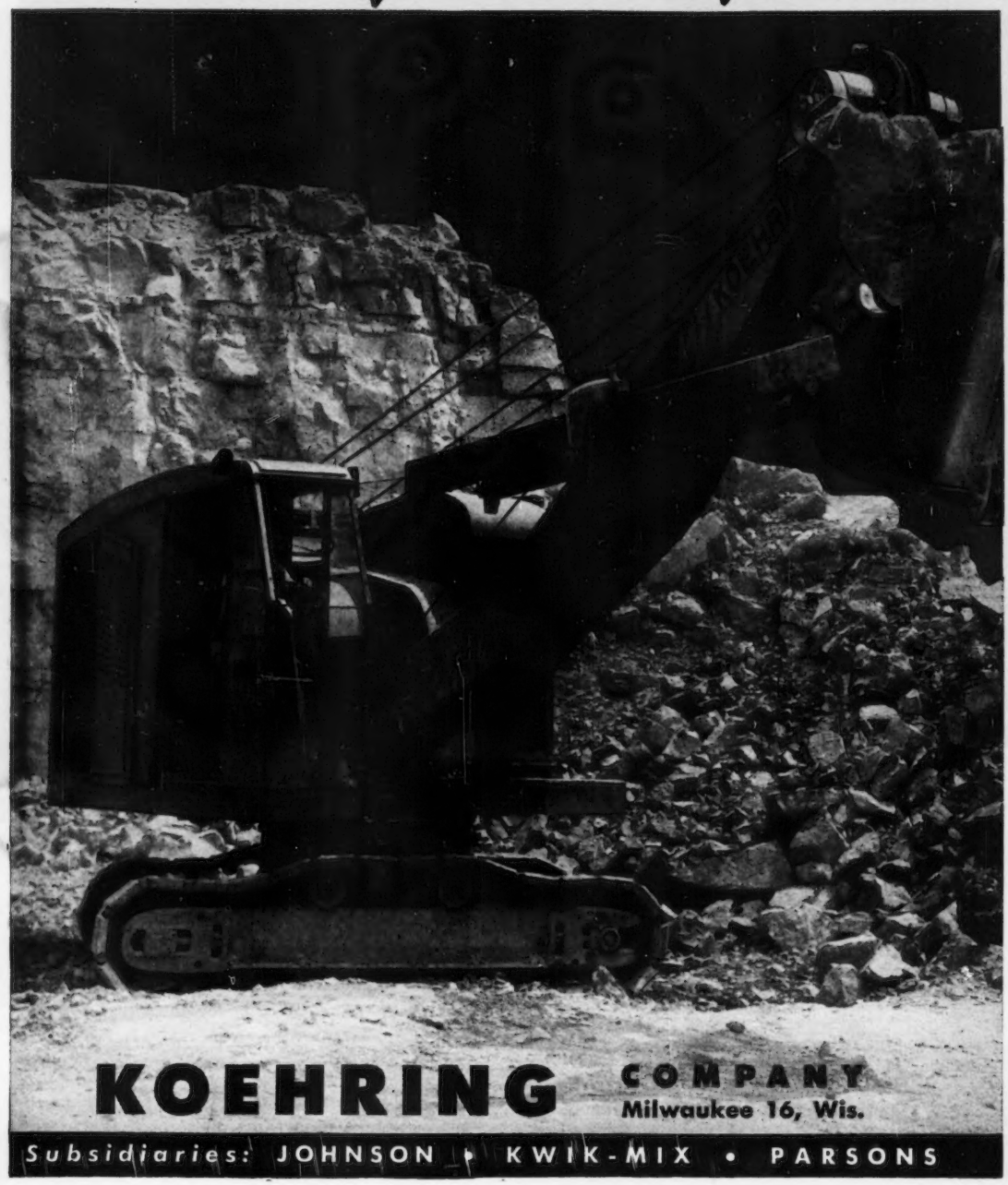

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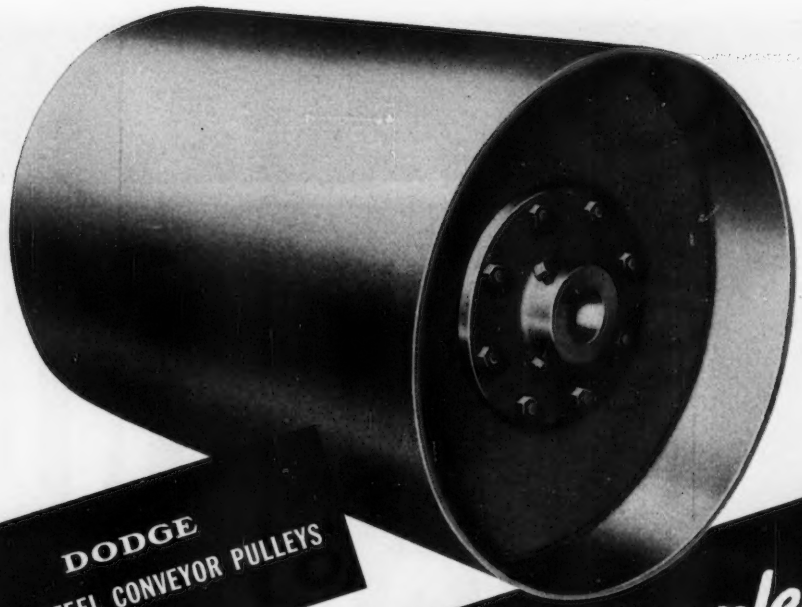

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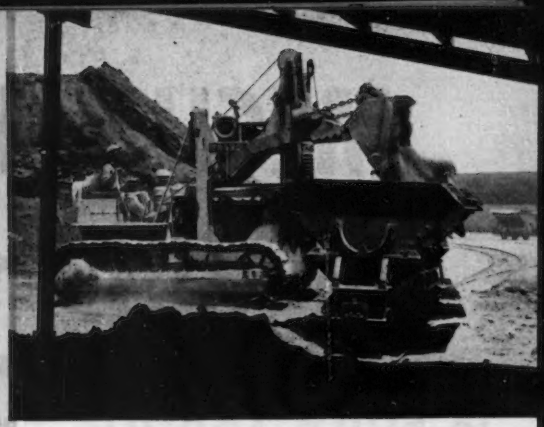
helps an ancient land feel young



"Caterpillar" Diesel D6 Tractor with Trackson Traxcavator loading iron pyrites from stockpile into railroad cars for the Hellenic Mining Co., Ltd., Isle of Cyprus. (See main text about additional "Caterpillar" equipment.)

This 12-ton Plymouth locomotive, powered with a "Caterpillar" Diesel D13000 Engine, hauls 6 to 15 cars (8 to 9 tons gross weight each) over an 11½-kilometer track from Hellenic's mine to plant. A second unit is similarly "Caterpillar"-powered.

CYPRUS, colony of the early Phoenicians and many successive nations of history, is the scene of this development of an ages-old natural resource through the use of modern methods, machinery and power.

Two "Caterpillar" D6 Tractors with Traxcavators
One "Caterpillar" D4 Tractor with Traxcavator
Two "Caterpillar"-powered Plymouth locomotives
Two "Caterpillar" D4400 stationary Engines

are operated by the Hellenic Mining Co., Ltd., of Nicosia, Isle of Cyprus, in the handling of iron pyrites. "Caterpillar" equipment was preferred because it takes rugged equipment to handle this very heavy mineral.

Extracurricular duties for the tractors include loading out mined, shot gypsum into hoppers at the mine, and stockpiling material at the plant. Production averages 700 tons of pyrites and 200 tons of gypsum per day.

To today's economic needs, military requirements are adding heavy demands for "Caterpillar" products. Talk over your machinery requirements with your "Caterpillar" dealer. He has ample parts stocks to keep your present equipment doing its job and will do his utmost to make prompt delivery of new machines.

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A later refinement of the loader, the Joy 18-HR-2, is now being used extensively in the area. Its 12-ton-per-minute loading capacity permits the fastest possible movement of ore from the face. Like the loader, the Joy 60-E Shuttle Car is specially designed for the rugged duty of ore and rock handling with a minimum of maintenance.

Another machine helping to reduce costs in Birmingham mines and other mining areas is the rubber-tired Joy Drillmobile. It moves in and out fast, sets up quickly, assures drilling your rounds in minimum time and at least cost per foot of hole. ● Let us help you apply Joy Equipment to *your* conditions.

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One of the Joy continuous-type trackless loaders operating in the Birmingham Mining district, shown above loading hard, abrasive material into a Joy 60-E Shuttle Car. Controls are grouped for easy, one-man operation.

The self-propelled Joy Drillmobile is a fast-tramming, highly maneuverable machine, available in three sizes to suit any conditions. Drills are mounted on Joy Hydro Drill Jibs, which make hole-positioning easy and accurate, and permit remote control for utmost safety.

The 60-E, below, is a cable-reel operated car, easily handled and highly maneuverable.

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STATIONARY AND SEMI-PORTABLE AIR COMPRESSORS—Models to deliver from 1.6 to 3656 C.F.M.

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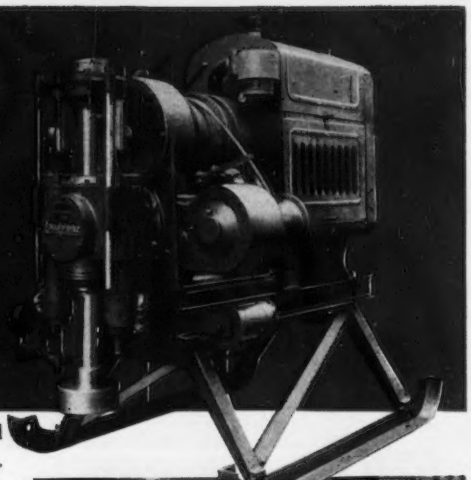

That's why Longyear insists on selected materials, and precision machining in building diamond core drills. Here are examples of parts or processes that must meet critical tests: sound castings, high-grade alloys for gears and shafts, perfect alignment, precise tolerances, quality bearings, thorough lubrication. These features give Longyear drills endurance, steady performance, economical operation. Select any Longyear model and know that goodness goes all the way through.

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The Junior and UG Straitline core drills illustrated are popular models. They repeatedly demonstrate to users the value of sound internal construction. Operators are getting STEADY DRILLING PERFORMANCE, and LARGER FOOTAGES per shift because there are no break-downs due to inferior materials or workmanship. These factors add up to OPERATING ECONOMY. The word gets around. That is the reason for new orders, and why repeat orders keep coming in. Think it over and let us quote you on suitable drill equipment for your next job.

CORE DRILLS AND SUPPLIES

Longyear manufactures a complete line of core drills—large or small, for surface or underground use. There is a quality-built model suited to your needs.

Also, quality-built diamond drill accessories and standard supplies are available from stock.

Write us for specific information.

Upper Picture—Junior Straitline, Diesel Driven
Capacity: 1000′ of EX core or 800′ of AX core

Lower Picture—UG Straitline, Air Driven
Capacity: 2000′ of EX core or 1600′ of AX core

Each model is equipped with screw feed or hydraulic drilling head; also may be supplied with air, electric, gasoline or Diesel motive power.

Remember, we do core drilling under contract. You may prefer to use this service rather than to buy drills. Consult us on your requirements.

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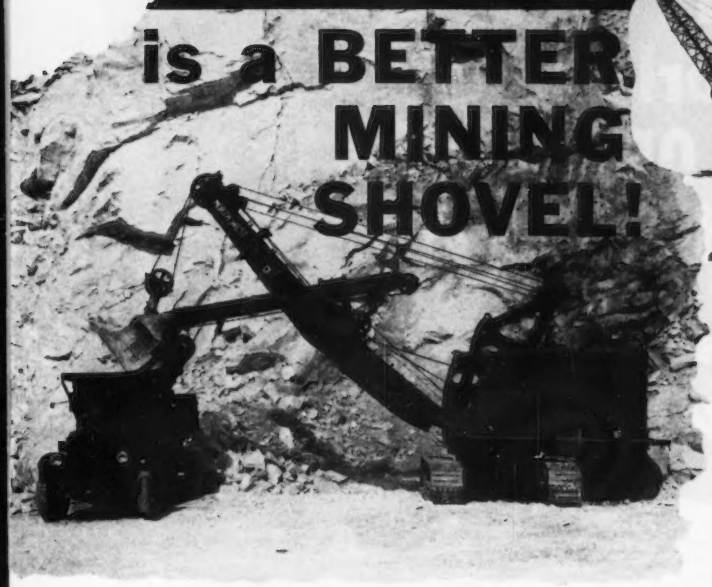

BETTER TRAVEL

The Northwest Steering is smoother — easier on operator and machine with *positive* traction on *both* crawlers while turning as well as when going straight ahead.

BETTER CONTROLS

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BETTER SWING CLUTCHES

Uniform Pressure Swing Clutches that grip easily, are free from jerks and grabs that make spotting the load difficult and waste digging time.

THE Northwest is a real Rock Shovel proved in hard rock work. Greater simplicity in design makes maintenance easier. Unusual mobility as compared with other crawler designs saves time clearing for shots. Fast swing and high capacity under many conditions improves output over larger equipment. The Helical Gear Drive gives smooth trouble-free transmission of power. Cast Steel Bases and Machinery Side Frames are ruggedly built and maintain shaft alignment and Ball and Roller Bearings on all high-speed shafts cut power losses to the minimum.

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CUSHION CLUTCH

Reduces shock overloads of heavy digging *before* they can damage machinery.

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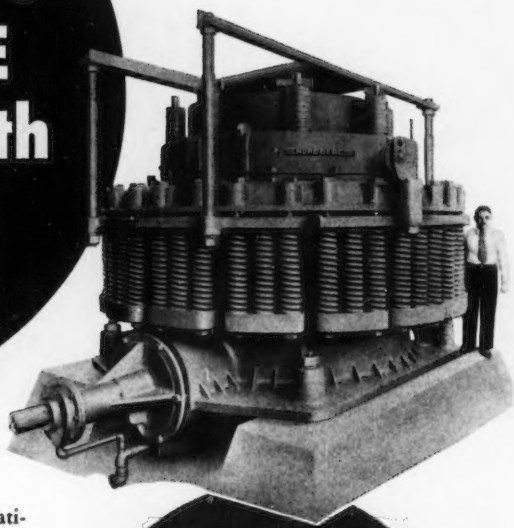
NORTHWEST

Convertible for any Mining Material Handling or Excavation Problem

MOST of the World's COPPER ORE is reduced with *Symons Cone Crushers*



To keep pace with modern industry's insatiable demand for more and more *copper* necessitates the use of the most efficient ore reduction machinery.

That's why most of the world's *copper* ore is reduced with Symons Cone Crushers. No other crushers can match their performance in producing a maximum of finely sized product at a minimum cost per ton.

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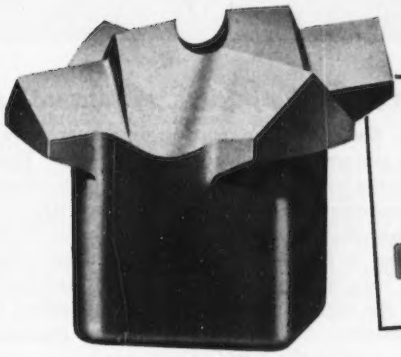

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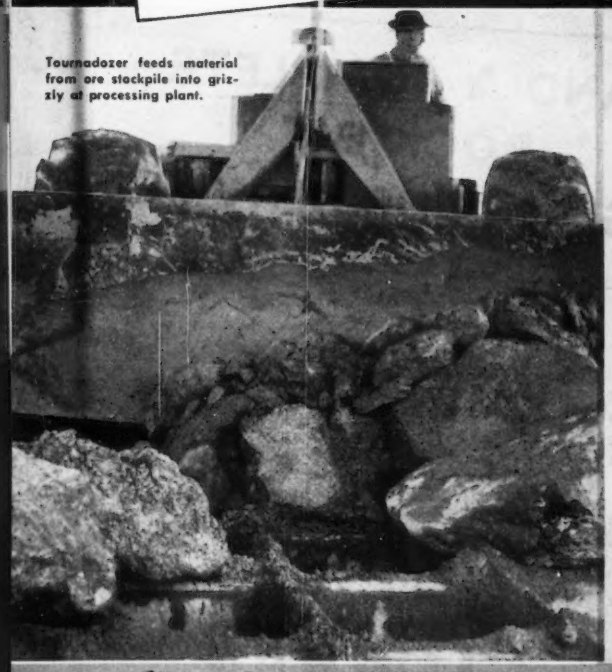
3. Spreads waste material at dump
4. Maintains quarry rock stockpile
5. Cleans around two 2½ yd. shovels



Tournadozer feeds material from ore stockpile into grizzly at processing plant.

Near Little Rock, Arkansas,

a large Eastern manufacturing firm operates an ore pit and processing plant 24 hours a day. They are mining bauxite rock, which must be crushed, then processed to recover aluminum ore. On this multi-handling operation, they have the problem of doing a lot of widely-scattered dozer jobs within very short periods of time . . . and have found the answer in a 19 m.p.h., rubber-tired C Tournadozer. "This *one* LeTourneau machine has been doing the work of *two* crawlers on our operation," reports the Plant Superintendent.

Tournadozer's principal job during its regular 12-hour work schedule is dozing quarry rock into 4 to 8 grizzlies. It utilizes the previous waiting periods to handle waste disposal . . . pulling a 13-yd. bottom-dump wagon ½ mile from gyp conveyor to dump area . . . spreading the material . . . then returning ½ mile to conveyor, where wagon is uncoupled and reloaded while Tournadozer "lends a hand" on other odd-lot, maintenance-type jobs.

Mail to: R. G. LeTOURNEAU, INC., Peoria, Illinois

LETOURNEAU EQUIPMENT

NAME.....

TITLE.....

COMPANY.....

STREET.....

CITY, STATE.....

Please send information on

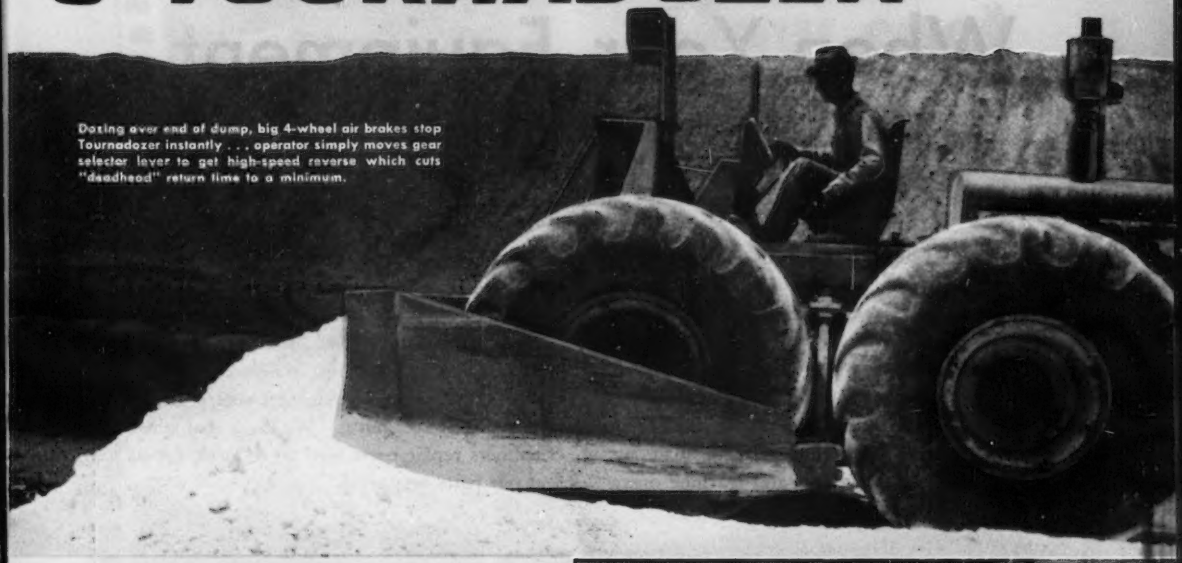
- ☐ 180 h.p., 19 m.p.h. C Tournadozer
- ☐ 122 h.p., 19 m.p.h. D Tournadozer

for use with:

- ☐ Bulldozer
- ☐ Angledozer
- ☐ Snow Plow
- ☐ Side Crane
- ☐ Carryall
- ☐ Rooter
- ☐ Other Drawn Equipment

doubles crawler output

C TOURNADOZER



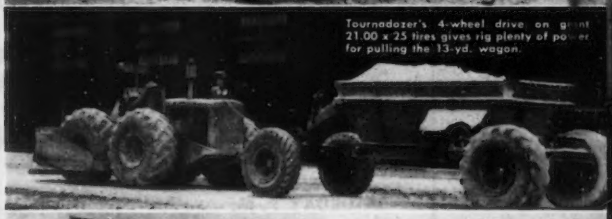
Dozing over end of dump, big 4-wheel air brakes stop Tournadozer instantly . . . operator simply moves gear selector lever to get high-speed reverse which cuts "deadhead" return time to a minimum.

In addition, Tournadozer is on call 24 hours a day to level quarry rock stockpile . . . and to clean around 2 electric 2½-yd. shovels working inside storage sheds. In an average 24-hour period, the "C" travels between 30 and 35 miles, part of the distance over pavement, part cross-country . . . crosses railroad tracks and curbs without planking . . . works frequently on concrete without damage to surface or to tires.

On all five of these major dozing and pulling assignments, the versatile Tournadozer consistently outproduces crawler-type tractors. Its fast, "runabout" ability has helped maintain steady, balanced production of pit and plant at all times.

With Tournadozer's 19 m.p.h. forward and 8 m.p.h. reverse speeds, you, too, can do more jobs, and get more work done at a lower cost per job. Let your LeTourneau Distributor show you more job-proved facts and figures. Why not write, or call him . . . TODAY!

Loaded with waste material from ore process conveyor, wagon is quickly coupled to Tournadozer for ½-mile haul to dump area.



Tournadozer's 4-wheel drive on giant 21.00 x 25 tires gives rig plenty of power for pulling the 13-yd. wagon.

As waste material is dumped, high-speed C Tournadozer spreads previous load with its electric-control 2½-yd. bulldozer blade

Tournadozer, Angledozer, Carryall, Rooter—Trademark Reg. U.S. Pat. Off. M27

LETOURNEAU PEORIA, ILLINOIS — JOB-PROVED The World Over — **TOURNADOZERS**

IT'S RUBBER THAT PUTS THE ACTION IN TRACTION

Allis-Chalmers Service Does Not Stop When Your Equipment is Installed

YOU SEE, Allis-Chalmers maintains a staff of special repair parts service experts, whose job is to see to it that emergency repair orders are given emergency treatment.

On the alert day and night (they can be reached at home), these men get on the job at once when an emergency call comes through. Working closely with shop management, they locate parts or materials, make sure that shop machinery and machine operators get on the job right away. Most important — *they stay on the job* until the needed part is on its way and actually delivered to you!

Fast, dependable repair parts service is an important reason why many men in industry keep on specifying Allis-Chalmers equipment year after year. As one A-C customer put it, "We know that when Allis-Chalmers repair parts men go to work for us we'll get our parts very soon."

A-3284

New Crusher Shaft Delivered Two Days After Old One Breaks!

FRIDAY P. M.
A gyratory crusher goes down with a broken mainshaft in Watertown, N.Y. plant of General Crushed Stone Company, stopping production.

SATURDAY A. M.
Supt. Bovee, of General Crushed Stone, calls Allis-Chalmers Maintenance and Repair Section, explains predicament. An Allis-Chalmers repair parts expert arranges to follow through at once.

SATURDAY P. M.
New mainshaft and necessary auxiliary parts are rounded up in West Allis-Works (where they are held in readiness for just such an emergency) and leave A-C yards at 6:25 p.m. Saturday. Meanwhile, Allis-Chalmers Traffic department is able to speed shipment by making a route change at Chicago, saving 48 hours. Repair parts man calls Supt. Bovee, tells him shipment will arrive Syracuse, N.Y. 6:30 p.m. Sunday, and supplies car number.

SUNDAY P. M.
Truck is waiting at Syracuse to take shipment direct to Watertown, N.Y.

MONDAY
Crew works Sunday night and Monday completing installation of new mainshaft and parts. Plant is back in operation first thing Tuesday morning. (Monday was a holiday, so hardly any time was lost at all.)

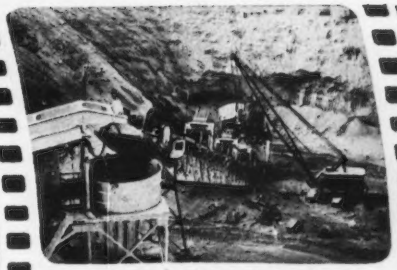
SERVICE LIKE THIS *is not exceptional when emergencies exist. It's typical of the repair parts service you can expect after your Allis-Chalmers machinery has been installed. Allis-Chalmers, Milwaukee 1, Wisconsin.*

Allis-Chalmers will be glad to recommend spare parts for your equipment — the best protection you have against shut-downs!

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Sales Offices in Principal Cities in the U. S. A. Distributors Located Throughout the World.



Shovel and Diesel dragline feed ore through grizzly to 60" pendulum conveyor leading to portable crusher at start of 9-belt conveyor system.

Crushed gravel is stock-piled by 700-foot conveyor suspended from tower.

Reclaim tunnel (left) feeds conveyor to washing plant housing jigs, tables, amalgamators and grinders, and classifying units.

Boom stacker transfers sands from washing plant to waste pile.

High tonnage – low cost

Conveyor Belt System Makes Gold Mine "Pay"

OUTSTANDING mining operation in the western states, this gold mine has been handling up to 17,000 tons per day of porphyry gold since January 1950—all over a conveyor belt system belted according to the recommendations of the G. T. M.—Goodyear Technical Man.

Secret of the mine's success is the trouble-free performance of its 9-belt system, belted with Goodyear Style B conveyor belting—designed to handle highly abrasive materials. If you have a bulk-load handling problem, it will pay you to consult the G. T. M. for conveyorization recommendations. See your nearest distributor of Goodyear Industrial Rubber Products, or write Goodyear, Akron 16, Ohio.

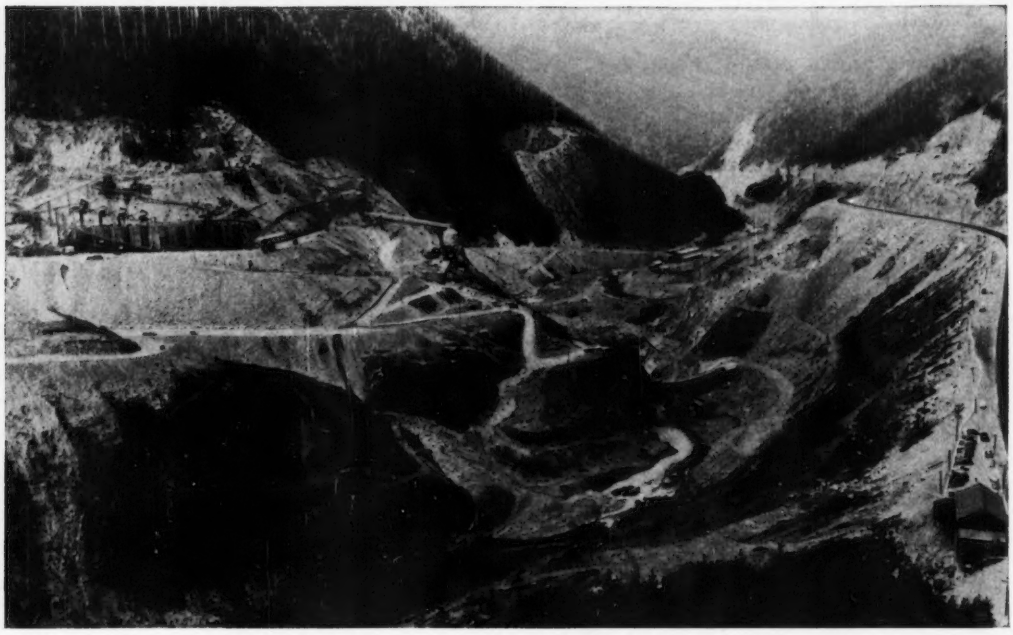
GOODYEAR INDUSTRIAL RUBBER PRODUCTS
GTM-Specified STYLE B CONVEYOR BELT
for HANDLING ABRASIVE MATERIALS
A
Tough cover resists abrasion and gouging
B
Multi-plies of highest grade duck, frictioned with 16-19 pound stock for added flex-life
C
Breaker strip gives further protection to carcass and resists cover stripping

FOR HOSE, FLAT BELTS, V-BELTS, MOLDED GOODS, PACKING, TANK LINING, RUBBER-COVERED ROLLS built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor.

We think you'll like "THE GREATEST STORY EVER TOLD" —Every Sunday—ABC Network

GOODYEAR

THE GREATEST NAME IN RUBBER



Amidst breathtaking scenery, Detroit Dam will span this rocky gorge of the North Santiam. The river is now diverted just upstream from the dam site. *Official Corps of Engineers Photo.*

DETROIT DAM TO SUPPLY POWER, TAME FLOODS ON OREGON'S NORTH SANTIAM RIVER

Detroit Dam will add another vital link to the chain of hydroelectric power plants in the Northwest Power Pool to which Bonneville and Grand Coulee Dams are now the major contributors. Located 100 highway miles south of Portland, Detroit Dam will be of the concrete gravity type, 1580 ft long, and will create an eight-mile-long reservoir.

Excess water will be stored during critical run-off periods, reducing flood stages on the picturesque North Santiam River. Two generating units will feed 100,000 kw to this power-hungry region when the dam is completed in 1953. Big Cliff Dam, a smaller installation, will be built about three miles downstream from Detroit Dam. In addition to supplying power and controlling floods, these structures will function in the interests of irrigation, navigation, pollution abatement and recreational development.

The entire Detroit Project is under the supervision of the Corps of Engineers, U. S. Army, Portland District. Consolidated Builders, Inc., Portland, is the prime contractor on Detroit Dam.

Bethlehem Hollow Drill Steel bites into rock as these wagon drills go into action at a nearby quarry which supplies aggregate for Detroit Dam.

Large quantities of Bethlehem Hollow Drill Steel are being used to quarry aggregate from the rugged hills near by. And at the construction site, where 800,000 cu yd of excavation is under way, this drill steel is on the job, boring tough bedrock day after day.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL ★ BETHLEHEM STEEL ★

new!

GOODMAN 10 TON METAL MINE LOCOMOTIVE

WITH TWO 60 HP MOTORS; SINGLE REDUCTION SPUR GEAR DRIVE FOR 24" GAUGE

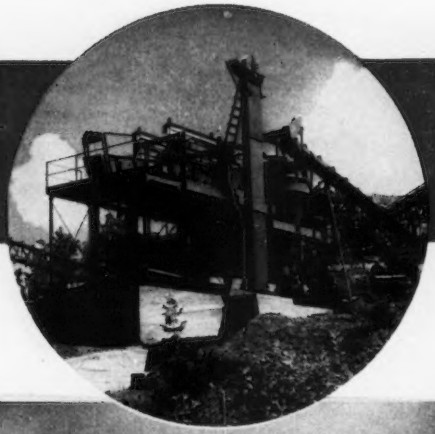
Practical features of this rugged, heavy duty unit include: hydraulic brakes, roller bearing journals, camtactor control, transverse equalizers, sealed beam headlights. Can be built for 24" to 36" gauge or 30" convertible to 24".

plus full protection for electrical units and motors against water and muck—customary Goodman construction for metal mine service.

Goodman locomotives in trolley, storage battery and combination types cover the entire range of metal mine service. Let us help you select the Goodman locomotives which meet your particular mine conditions.

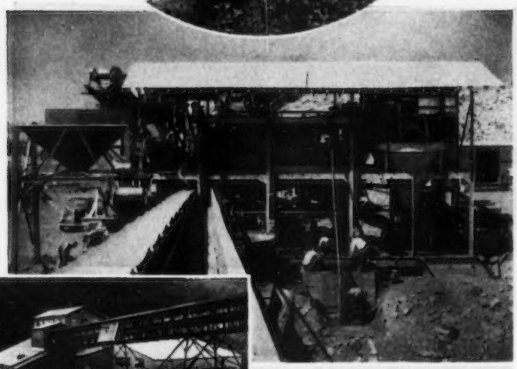
Goodman MANUFACTURING COMPANY

HALSTED STREET at 48th • CHICAGO 9, ILLINOIS



26 MILLION TONS ANNUALLY!*

WITH 52 WEMCO MOBIL-MILLS



INDUSTRY-WIDE ACCEPTANCE of the WEMCO MOBIL-MILL is demonstrated by this outstanding record of use (*average rated capacity) by operators in both the metallic and non-metallic mining fields. The success of these prefabricated heavy media plants is the result of five important advantages:

- ***PREFABRICATION***— *furnished complete, ready to install*
- ***INSTALLED FOR YOU***— *by skilled WEMCO field crews*
- ***LOW COST***— *both initial cost per ton capacity and operating costs are low*
- ***CLEAN SEPARATION—HIGH RECOVERY***— *due to accurate easily controlled HMS process*
- ***WIDE APPLICATION***— *due to amenability of HMS to a wide variety of ores*

VERSATILITY of the Mobil-Mill is demonstrated by its efficiency in milling a wide variety of minerals, including:

GALENA	BROWN IRON ORES
BARITE	BASE METALLICS
HEMATITE	ANTHRACITE COAL
FLOURSPAR	BITUMINOUS COAL
GRAVEL	SPODUMENE
LEAD-ZINC SEMI-SULPHIDES	DIAMONDS

WEMCO MOBIL-MILLS may be rented or purchased in several sizes to treat from 5 to 275 T. P. H. feed. Design flexibility and the use of either cone or drum type separator make possible a Mobil-Mill to fit your special requirements at no extra cost.

WRITE TODAY *for information on the application of Mobil-Mills to your milling needs.*

WEMCO

WESTERN MACHINERY COMPANY

760-766 FOLSOM STREET · SAN FRANCISCO 7, CALIFORNIA

WKE (HMS) Mobil-Mill • Coal Spiral • Standard Thickeners (HMS) Thickeners • (HMS) Media Pumps • Hydroseparators (HMS) Densifiers • (HMS) Separatory Cones • "SH" Classifiers Sand Pumps • Conditioners and Agitators • Fagergren Flotation Machines • Dewatering Spirals • (HMS) Laboratory Units

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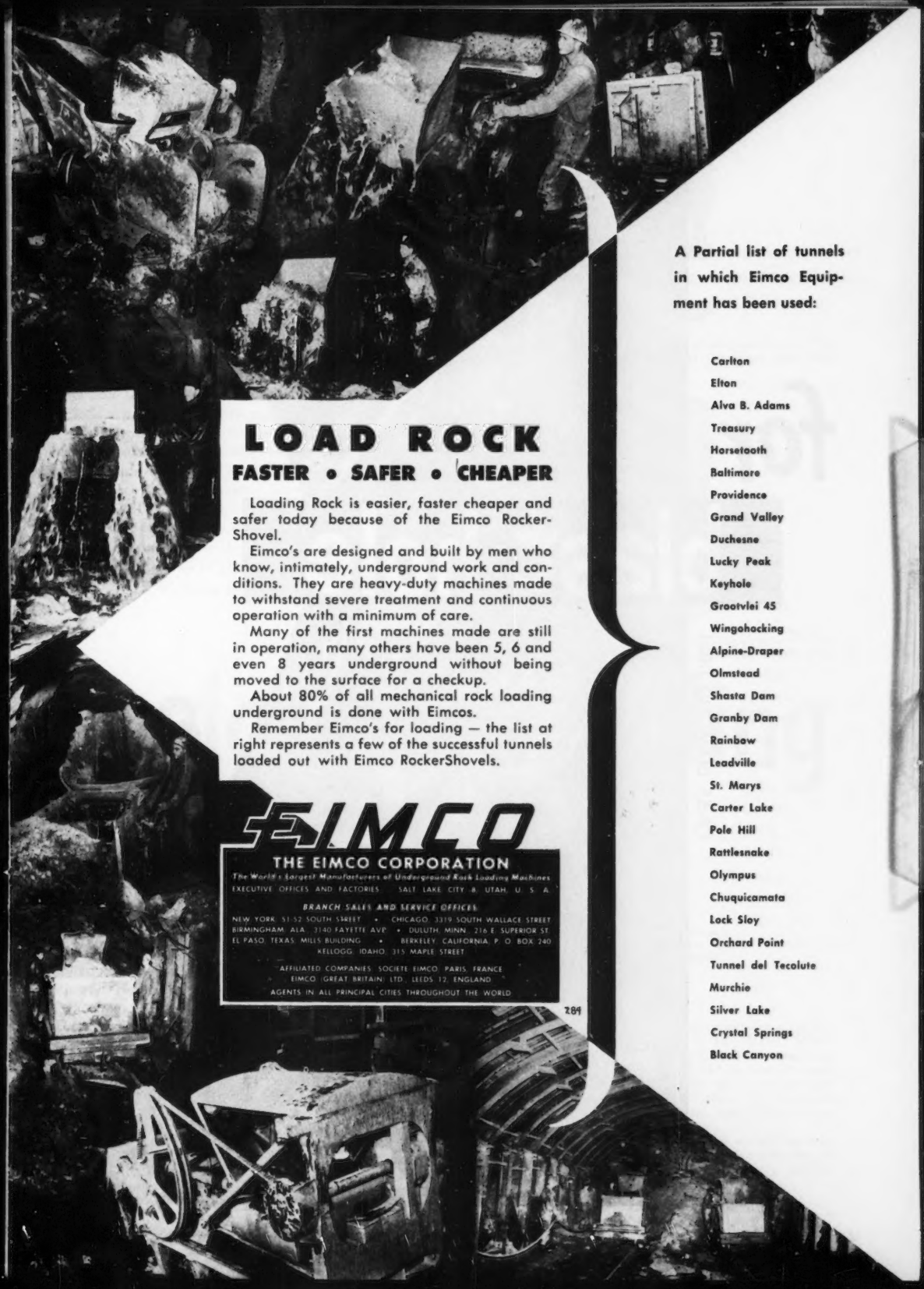

LOAD ROCK

FASTER • SAFER • CHEAPER

Loading Rock is easier, faster cheaper and safer today because of the Eimco Rocker-Shovel.

Eimco's are designed and built by men who know, intimately, underground work and conditions. They are heavy-duty machines made to withstand severe treatment and continuous operation with a minimum of care.

Many of the first machines made are still in operation, many others have been 5, 6 and even 8 years underground without being moved to the surface for a checkup.

About 80% of all mechanical rock loading underground is done with Eimcos.

Remember Eimco's for loading — the list at right represents a few of the successful tunnels loaded out with Eimco RockerShovels.

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 8, UTAH, U. S. A.

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KELLOGG, IDAHO, 315 MAPLE STREET

AFFILIATED COMPANIES: SOCIETE EIMCO, PARIS, FRANCE
EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND

AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

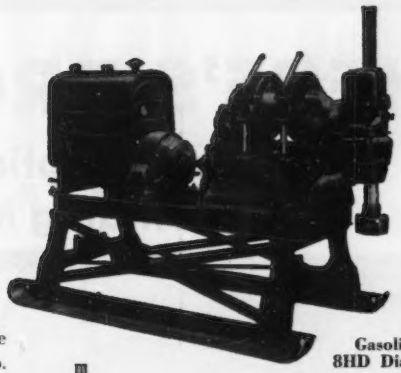
289

A Partial list of tunnels in which Eimco Equipment has been used:

- Carlton
- Elton
- Alva B. Adams
- Treasury
- Horsetooth
- Baltimore
- Providence
- Grand Valley
- Duchesne
- Lucky Peak
- Keyhole
- Grootvlei 45
- Wingohocking
- Alpine-Draper
- Olmstead
- Shasta Dam
- Granby Dam
- Rainbow
- Leadville
- St. Marys
- Carter Lake
- Pole Hill
- Rattlesnake
- Olympus
- Chuquicamata
- Lock Sloy
- Orchard Point
- Tunnel del Tecolute
- Murchie
- Silver Lake
- Crystal Springs
- Black Canyon

for blast hole and

CP-55 DIAMOND DRILL



Gasoline-driven CP No. 8HD Diamond Core Drill

Built for exploratory drilling from the surface, the gasoline-driven, skid-mounted CP No. 15HD and No. 8HD DIAMOND CORE DRILLS are readily moved from hole to hole under their own power.

Both are specifically designed for engineer's test borings, mineral prospecting and shallow oil structure drilling. Operating at the continuous high speed made possible by bortz bits, they give exceptional performance with remarkably low maintenance.

CP No. 15HD, with E-EX fittings, has a capacity of 2250 feet; CP No. 8HD, a capacity of 1250 feet. Both are also available with electric or Diesel drive, and with hydraulic head in place of screw feed.

Write for Bulletin 313

Gasoline-driven CP No. 15HD Diamond Core Drill

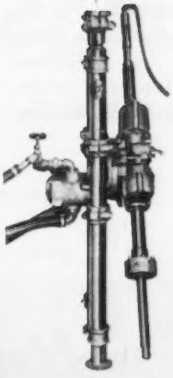
exploratory drilling

CP-55—FASTEST DRILL IN ITS CLASS

—designed around the improved CP Rotary Air Motor —the fastest, most powerful rotary motor on a diamond drill. For underground blast hole and exploratory drilling, the CP-55 DIAMOND DRILL is easy to handle; weighs only 160 pounds; requires a minimum amount of air per foot drilled.

Conservatively rated at 500 feet with E-EX fittings. Equally efficient for coring, non-coring or blast hole operations.

Write for Bulletin 318



Double-column mounted CP No. 12 Diamond Core Drill

Designed for underground use, the air-driven CP No. 12 DIAMOND CORE DRILL has a double-column mounting. Powered by a CP 25 h.p. rotary twin-air motor, it gives the same excellent performance as all other CP Diamond Drills. Its capacity, with E-EX fittings, is 1250 feet.

Motor, column and swivel head are readily dismantable for convenient underground transportation to "hard to get at" places.

Write for Bulletin 313

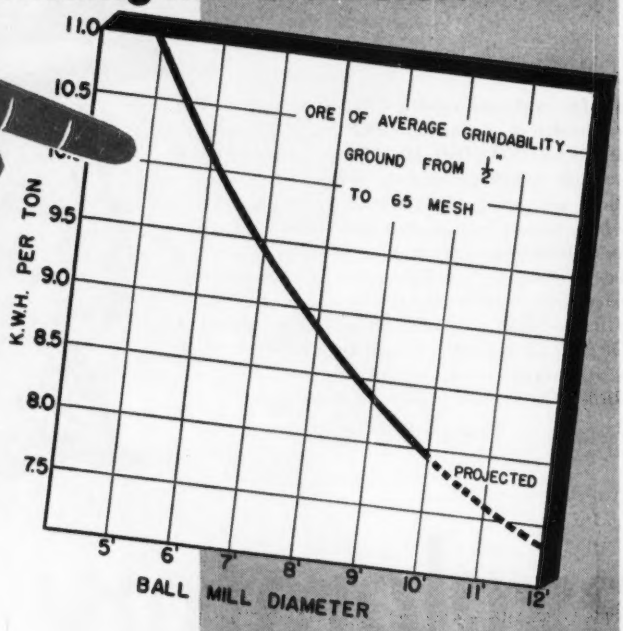
CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

HERE'S PROOF...

Power Consumption Varies With Grinding Mill Diameter!



To show you what happens to power costs with a change in mill diameter, here are data averaged from actual reports from commercial operators over a period of years. Note that power consumption per ton of feed is roughly in inverse proportion to mill diameter. **You cannot compare mills of different diameter on the basis of equal power.**

Size for size, MARCY low pulp line ball and rod mills have been proved to have greater capacity than grinding mills of any other type, with corresponding savings in power per ton of finished product and generally better metallurgical results. Ask our engineers to analyze your grinding problems without cost or obligation to you.

OTHER PRODUCTS

Massco Fahrenwald Flotation Machines; Genuine Wilfley Tables; Massco-McCarthy Hot Millers; Rock Bit Grinders; Density Controllers; Belt Feeders; Pinch Valves; Assay and Laboratory Supplies and Equipment; Complete Milling Plants; Constam Ski Lifts.

THE **Mine & Smelter** SUPPLY COMPANY

Main Office: DENVER, COLO., U.S.A.; El Paso; Salt Lake City; 1775 Broadway, New York, N. Y.

Representatives: Canadian Vickers, Ltd., Montreal; W. R. Judson, Santiago and Lima; The Edward J. Nell Co., Manila, P. I.; The Ore & Chemical Co., 80 Broad St., New York 4, N. Y., for Continental Europe.

ROCK RATED!

FOR HEAVY GOING

P&H *Magnetorque**

SLICKEST SWING YOU'VE EVER KNOWN!

It's everything you've wanted for more profitable rock handling . . . It's the P&H 955-A (2½ yd. shovel) . . . newer . . . better . . . proving it where the going is heaviest. Here's why:

P&H MAGNETORQUE ELECTRIC SWING. The smoothest, slickest swing you've ever known . . . yours for the full life of your machine. Old style swing frictions are *out* . . . all their troubles, adjustment and replacement costs.

SMOOTHER OPERATION means less strain on machine and operator. **GREATER STABILITY** gives you increased digging ability. **ALL-WELDED** for maximum strength.

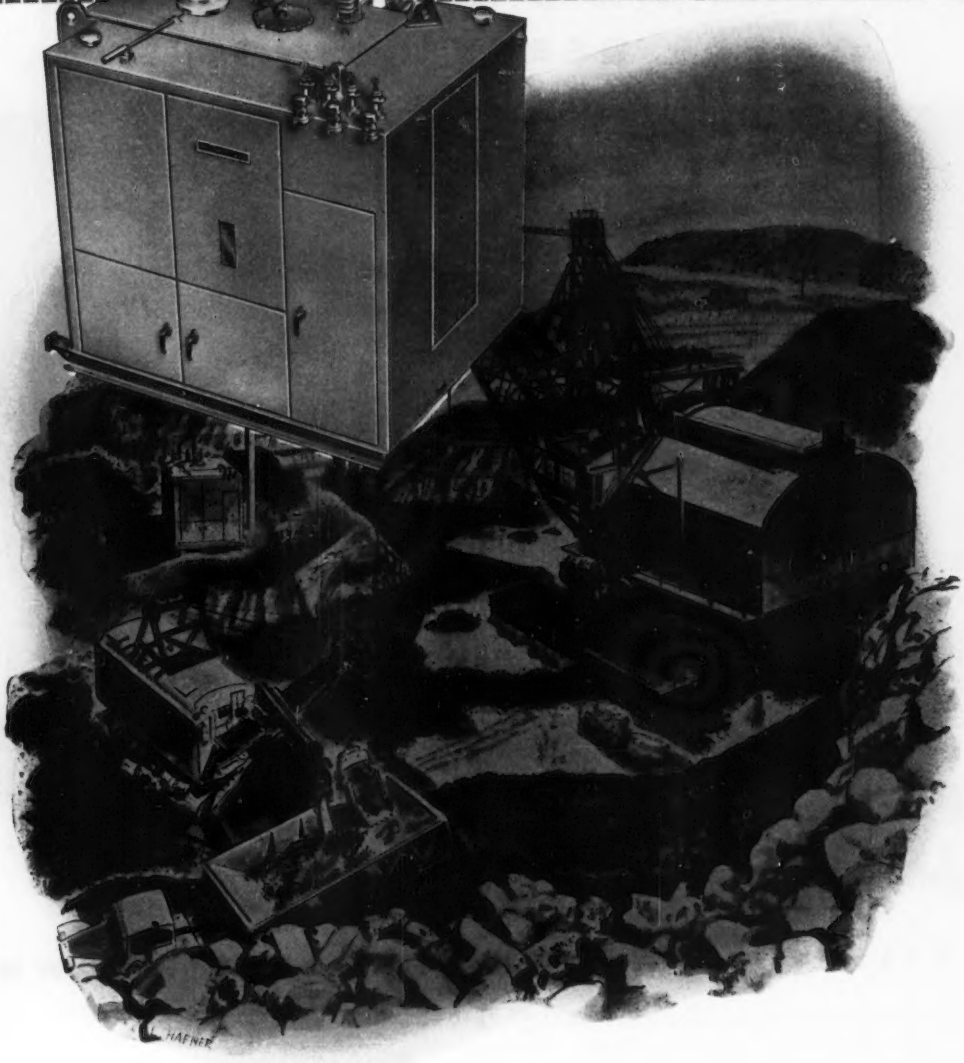
Ask to see the one working nearest you. It's the 2½ yd. version of the famous 1055 (3½ yd.).

P&H **EXCAVATORS**
4454 W. National Ave.
Milwaukee 14, Wisconsin
HARNISCHFEGER CORPORATION

*T. M. of Harnischfeger Corporation for electro-magnetic type clutch.

EXCAVATORS • OVERHEAD CRANES • HOISTS • ARC WELDERS & ELECTRODES • SOIL STABILIZERS • CRAWLER & TRUCK CRANES • DIESEL ENGINES • CANE LOADERS • PRE-ASSEMBLED HOMES

YOU CAN BE SURE.. IF IT'S
Westinghouse



"CSP"® POWER TRANSFORMERS *Save*

Installation...Maintenance...Load-Change COSTS

The quickest, easiest and most economical way to save on power costs is to install a Westinghouse "CSP" Power Transformer. Here's a *complete single-feeder substation* that saves you dollars right from the start.

Quick Installation. The "CSP" Power Transformer can be installed on either a concrete or a wooden stringer foundation. Just place the transformer on the foundation, tie in transmission and feeder lines and a complete single-feeder substation is ready for operation.

Simplified Maintenance. Here's a neatly designed and compact power transformer that enables all maintenance to be done from the ground level. The instrument and control panel is readily accessible and easy to read. It's completely enclosed to give absolute protection for year-round weather conditions.

Easy to Move. If load center changes, the integral substation may be easily . . . inexpensively . . . and completely moved. If loads grow, additional units can be easily tied in on the line.

In all "CSP" (Completely Self-Protecting) Power Transformers you get complete lightning, surge and fault protection . . . plus automatic voltage regulation, load switching and metering. In one package you have the best, most dependable single-feeder substation built today. For further information contact your nearest Westinghouse dealer or write for Booklet B-4692, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70578

Westinghouse

"CSP" POWER TRANSFORMERS

For Greater Strength and Shock Resistance

"Look Under the Hood" of a BULL DOG V-BELT!

1. The covers of BULL DOG V-BELTS . . . as durable as they are with their plies of closely woven, bias cut fabric represent only part of the BULL DOG story behind the long life and outstanding performance of these belts. That's why we say "Look under the hood!"

2. Immediately beneath the cover is the BWH-developed compression section of fabric and quality-controlled compounds. This is the basic reason why Bull Dog V-Belts *both* run cooler and DO NOT CRACK OR DETERIORATE UNDER SEVERE FLEXING.

3. Third basic factor in Bull Dog V-Belt quality is the specially engineered BWH Cord Section — exceptional in tensile strength — and the answer to the belt's heavy load carrying capacity and ability to absorb shock loads. Thank a new technique in processing these cords for MINIMUM STRETCH and the advantages of fewer adjustments, less slippage, longer belt life.

Put V-Belt problems behind you — ask your BWH distributor for a set of Bull Dogs. Do it as soon as you can!

TOUGH PROBLEMS INVITED — Don't hesitate to ask us or your nearest BWH distributor about your power transmission belting, conveyor belting and hose problems. We're specialists in making mechanical rubber products work *better, longer.*

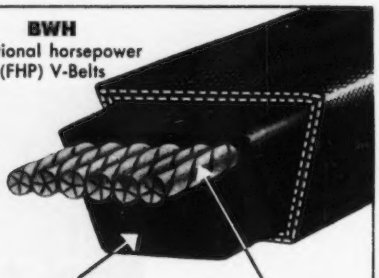
Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS. • P. O. BOX 1071, BOSTON 3, MASS., U.S.A.

BWH
Fractional horsepower (FHP) V-Belts



COMPRESSION SECTION, engineered to withstand continual flexing.

BULL DOG CORDS, comprise a powerful, load-carrying section.

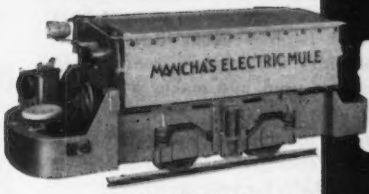
Hitch your pay loads to a MANCHA ELECTRIC MULE

Here are two TITANS FOR YOUR *TOUGH JOBS!*

Look! Rolled steel side frames — alloy steel axles . . . cast steel bumpers! No wonder it can take such a walloping in accidents and collisions!

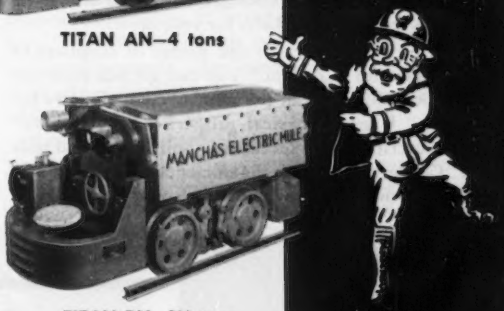
They're rugged and tough, and because their TRACKMASTER* design distributes weight equally to all four wheels, they're tops in track performance. Longitudinal equalizers, with a special spring suspension, level out rough track and cushion shock to motor battery and electrical units. Maintenance is lower, riding comfort is greater. Further, the TRACKMASTER design incorporates anti-friction bearings throughout to maintain proper alignment of all running parts. Put these locomotives on the job and they stay there.

*Reg. U.S. Pat. Office



TITAN AN—4 tons

What a battery box! . . . NOTHING seems to phase it, not even falling rock.



TITAN BN—2½ tons

Mancha's Electric Mules are available in a variety of sizes, horsepower, and battery capacities. We invite inquiries regarding storage battery locomotives suited to your particular requirements. Mail the coupon for illustrated bulletin showing performance charts and complete specifications.

Mancha Storage Battery Locomotive
Division GOODMAN Manufacturing Company
4850 S. Halsted St., Chicago 9, Ill.
E&M.J—2/51

NAME _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

MANCHA STORAGE BATTERY LOCOMOTIVE

Division **GOODMAN** *Manufacturing Company*

4850 SOUTH HALSTED STREET CHICAGO 9, ILL., U. S. A.

HEAVIER LOADING is possible on conveyor belts built with "Cordura" Rayon. This yarn is stronger than natural fibers commonly used. It packs extra strength into conveyor belts and enables them to carry loads to the capacity of power equipment.

WHY YOUR NEXT CONVEYOR BELT SHOULD BE BUILT ON DU PONT "CORDURA" RAYON

The next time you need a conveyor belt, ask your supplier about the remarkable performance of belts built on Du Pont Cordura* High Tenacity Rayon. This industrial rayon provides far greater strength than natural fibers commonly used, and makes a thinner, more workable belt, *at no extra cost.*

This yarn, which puts toughness in heavy-duty truck tires and makes thinner, stronger hoses, can also make more efficient conveyor belts for your mine.

We'll be glad to furnish the names of suppliers of belts made with "Cordura." You can get full information about "Cordura" in the new manual, "Sinews for Industry." It gives physical properties of "Cordura" rayon, describes many successful applications and tells how "Cordura" improves the efficiency of conveyor systems. For your free copy, address Room 4529, Rayon Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

*Reg. U. S. Pat. Off.

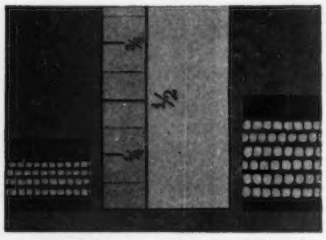
DU PONT "CORDURA" HIGH TENACITY RAYON

DU PONT

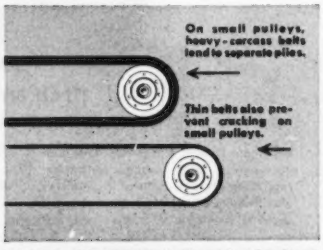
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

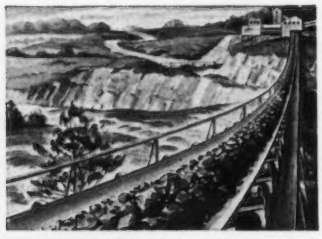
for RAYON . . . for NYLON . . . for fibers to come look to DU PONT



GREATER STRENGTH of belts built with "Cordura" is illustrated above. At left is cross-section of four-ply belt sinewed with "Cordura." It's stronger than conventional 6-ply belt at right, yet only half as thick. This thin, light belt is particularly desirable where panel equipment is moved frequently.



MORE FLEXIBLE. Belts built with "Cordura" have less tendency to crack and separate plies when run over small pulleys required in confined working space. And belts built with "Cordura" have less stretch, so less take-up room is needed. And they trough well under any loading conditions.



LONGER LIFTS. The high tensile strength of "Cordura" Rayon eliminates costly transfer points. For example, a belt reinforced with seven plies of "Cordura" can lift 1000 pounds of overburden per hour up a 15° slope over 1000 foot centers. It has design tension of 900 pounds per inch of width.

DORRCO DOINGS IN 1950

World conditions, as I write, are grim enough. They call for the response and concentration of purpose we know we would automatically get in an all-out war—but short of that, they do not come easily. The present situation is a tougher test for all of us, but one no less critical. The least profitable way to spend our attention and emotions now is in the search for scapegoats. If we were honest with ourselves, many of us would probably feel that our own ways of thinking or inaction had in some degree contributed to it. Let us apply this to the present and the future. They have enough to occupy us.

* * *

CLASSIFICATION—Our HX Classifier continues to take over the heavy-duty applications formerly handled by the FX. In this country nine duplex HX's are going in at an existing copper concentrator, while eight Quadruplexes and Quadruplex Bowls will be used in a 100 per cent expansion at another property.

The Dorrco Hydroscillator, and its work at Tennessee Copper, has been written about in several A.I.M.E. papers this year. This unit has reduced power consumption for fine grinding by yielding a definitely cleaner sand product. Its ability to produce clean, slime-free sand with only a small fraction of the water used in conventional hydraulic classifiers opens up promising new fields of application, such as the desliming of phosphate sands and the sand fractions of other non-metallic minerals.

JIGS AND CONES—The Dorrco Pan-American Jig continues to find favor in various types of dredge operations, and is now being applied to the beneficiation of iron ore in Minnesota and the concentration of tin ore in Malaya. The DorrClone (Dutch State Mines Cyclone) is entering new fields, notably the degritting of milk-of-lime and clay slurries, the desliming of mill tailings for use as mine back-fill, and the desliming of phosphate rock, sands, fine coal, and iron ore. Recently developed automatic control of discharge density has greatly improved operation under fluctuating feeds.

KRAFT MILL RECAUSTICIZING—1950 has been an active year in this field, with considerable replacement business and some expansion. Two-stage lime slaking, our new development, promises to improve control and assure a white digestion liquor of uniform strength, regardless of fluctuations in the burned lime feed.

SANITATION—The new Dorrco Aerator-Clarifier, a compact unit combining the functions of pre-aeration, flocculation and sedimentation in a single tank, increases the removals of suspended solids and B.O.D. over sedimentation alone.

Large-scale Dorr Multdigestion is used in recent installations at the Los Angeles Hyperion Plant for 245 million gallons of raw sewage per day, and Oklahoma City's Southside Plant, handling 25 million gallons.

Miami, Florida, is installing four 69 ft. dia. Dorrco Hydro-Treators to soften up to 52 million gallons of water a day at their new plant.

CANE SUGAR—There has been great activity this year in cane sugar, particularly in Brazil, where many factories have purchased our new Multifeed Clarifiers and Oliver-Campbell Filters.

ABROAD—Our six associated companies in Europe have been increasingly active and have handled a record volume of business. Three of them celebrated their 25th Anniversary in 1950, although one, Dorr-Oliver, Ltd., started as an agency in 1911. Another one, our seventh, Dorr-Oliver (India) Ltd., started this year.

Projects have included causticizing plants for Portugal and India, another fertilizer plant for Greece, and equipment for base metal production in Italy, Morocco, and the Middle East. India has a Biofiltration Plant operating in Bombay, with others under construction, and water plants for textile production.

Our first completely modern plant for the primary treatment of sewage in South America is under order for Recife, Brazil, to care for 130,000 people. Vacuum filtration and flash drying of sludge, plus the generation of power from sewage gas are to be features new to South American practice.

ION-EXCHANGE—All of the beet sugar factories employing our Ion-Exchange Systems report continued satisfactory operation and increase in the recovery of sugar. Our Continuous Water Softener, based upon ion-exchange principles, has been demonstrated commercially for municipal water supplies, and is also applicable to softening low pressure boiler feed water.

CONSULTING ENGINEERING—The Consulting Engineering Department is serving a broad and expanding field. Highlights this year were a pilot plant for the leaching, roasting and electrolytic treatment of copper ore in Michigan; the modernization of an old gold milling plant in South America, and the handling of a complete chemical fertilizer project in Greece.

FLUOSOLIDS AND FLUODRY—FluoSolids Systems for calcining refractory gold concentrates are being installed at Cripple Creek, Colorado, and one additional System added to the two existing systems at Red Lake, Ontario. Roasting of zinc sulfide concentrates has received much attention during the year, with one test unit being installed and another under design for this country.

The shortage of elemental sulphur, both here and abroad, has emphasized the need for securing more sulphur by roasting the plentiful supplies of iron sulfides—an ideal application for FluoSolids.

FluoDry, a newly developed application of the FluoSolids technique to drying and sizing fine material is being tried on 100 mesh dolomite to both dry and size at that mesh at a rate of 30 tons per hour.

* * *

The beginning of the year found us completing our general office move to Stamford, Connecticut, from New York, and making the required personal and corporate adjustments. The consensus of both staff and observers is that it has been a forward step which has added to our ability to serve.

Some time ago I came into the office and found an associate tearing his hair over something gone wrong. I had just read a review of Dr. Edward Hume's book "Doctors East and West" which told how, when his life's work at "Yale in China" seemed crumbling and his life in danger, he remained calm and full of faith. I told him the story and said then, "I, also, will not worry . . ."

Today, I think again that "Faith" and a serene belief in the final triumph of "Good" is our salvation.

To all friends "World-Wide" and our staff and associates comes our belief that the New Year will bring blessings.

John V. N. Dorr

Barry Place, Stamford, Conn.

DORRCO

An ever brighter picture
The Accurate Low-Cost Concentration
of
ANDALUSITE · BARITE · CEMENT ROCK · COAL · CHROMITE · DIAMONDIFEROUS GROUND · FELDSPAR
FLUORSPAR · GARNET · GLASS SANDS · GRAPHITE · GRAVEL · GYPSUM · ILMENITE · IRON OXIDES · KYANITE
MAGNESITE · MANGANESE · MICA · OLIVINE · PEARLITE · PHOSPHATE ROCK · POTASH · RHODOCHROSITE
SALT · SILLIMANITE · SCHEELITE · SPODUMENE · VERMICULITE · WOLFRAMITE · AND SIMILAR MINERALS
By Processes and Reagents
Offered by Cyanamid

If you mine or contemplate mining any of the above non-metallic or metallic oxide minerals, these simple facts are important to you:

1. Every last ton of these vital industrial minerals will undoubtedly be needed in the difficult days ahead.
2. Grade as well as tonnage will be important for defense-order needs.
3. Quickly, at low capital-cost, many properties can increase output; cut costs by less-selective mining; work deposits now considered to be sub-marginal; and ship higher-grade end-products by adding Processes and Reagents offered by Cyanamid.
4. A very considerable background of test results, design data and operating experience now exists on a long list of non-metallics to assure predictable performance in minimum time at lowest cost.
5. It is not one day too early to find out what Cyanamid can do to help you operate more efficiently into the future.

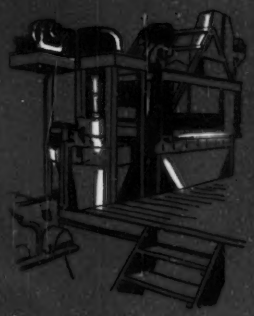
AMERICAN Cyanamid COMPANY

Printed in U.S.A.

WHAT CYANAMID OFFERS YOU

Cyanamid offers the two most efficient Separation Processes by Gravity Difference (Heavy-Media Separation and the Dutch State Mines Cyclone Separator) as well as a group of effective Specialized Reagents and Processes for Non-Metallic Froth Flotation. Alone or in combination, these Processes and Reagents are beneficiating thousands of tons per day in plants as small as 8 tons per hour and as large as 20,000 tons per day.

Cyanamid also offers, after preliminary discussion of your problem without cost or obligation, to run tests on your material in the Cyanamid Mineral Dressing Laboratory; to develop economic beneficiation flow schemes; to suggest proper reagent combinations; to cooperate with engineers of your choice in the design and construction of plants and to assist in tuning up the installation for most effective results.



WHAT HEAVY-MEDIA SEPARATION DOES

Heavy-Media Separation accurately separates valuable mineral from unwanted deleterious material in sizes down to 30 mesh by virtue of their differences in specific gravity. You set the gravity of the Heavy-Media "pool" at any gravity from 1.25 to 3.40 to get the separation you want. From then on, the Heavy-Media unit maintains that gravity within ± 0.01; automatically recovers and reconditions the medium, and feeds it back to the separating pool. On many minerals, you can mine non-selectively by the most economical method with assurance that the Heavy-Media unit will produce a uniform end-product, regardless of how feed fluctuates in quantity or content of unwanted material.

As Technical and Sales Representatives for Heavy-Media Separation Processes, we do not design, build or lease plants but can put you in touch with experienced engineering construction firms who do including those who can make speedy delivery of pre-fabricated "packaged plants" in capacities up to 300 tons per hour.

THE DUTCH STATE MINES CYCLONE SEPARATOR

This unique separation process is particularly applicable to the low cost separation of ¼" x 65 mesh and finer sizes. Employing a unique application of centrifugal and centripetal forces, the Dutch State Mines Cyclone Separator merits study (a) as a low-cost method of pre-concentrating where the feed contains only a small percentage of high-value minerals, (b) to produce a directly-marketable mineral concentrate from fine material, (c) to treat feeds which are inherently not amenable to jig or table treatment, or cannot be economically concentrated by froth flotation.

CYANAMID FROTH FLOTATION REAGENTS AND PROCESSES

Froth flotation is by far the most widely-used process for the beneficiation of fine material and as the final step in the treatment of feed that has been pre-concentrated by mechanical methods. In many instances, it has no peer and its use is constantly being expanded by the development of improved processes and reagents.

With the world's longest and broadest experience in the development and application of flotation reagents, Cyanamid offers the 800 Series, 700 Series, Oleic and other Fatty Acid Promoters, and Higher Alcohol Frothers, as well as Processes for their effective use. We welcome correspondence on these reagents and will gladly give you the benefit of our extensive experience in non-metallic flotation.

TAKE THIS FIRST STEP NOW

First step to more efficient, profitable operation is to send for the booklets listed below. The coupon is for your convenience.

Mineral Dressing Division
American Cyanamid Company
30 Rockefeller Plaza, New York 20, N. Y.

- ☐ MINERAL DRESSING NOTES #14, a 48-page technical booklet explaining *Heavy-Media Separation Processes*, showing flow schemes, plants and commercial operating results.
- ☐ MINERAL DRESSING NOTES #16D, describing in detail the *Dutch State Mines Cyclone Separator.*
- ☐ MINERAL DRESSING NOTES #15, describing *Cyanamid Flotation Reagents* and their fields of use.

YOUR NAME_____

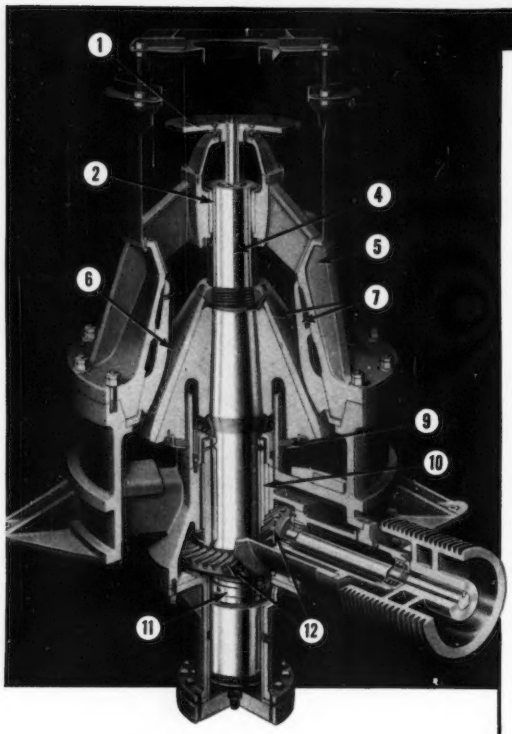
COMPANY_____

ADDRESS_____

A

MINERAL DRESSING DIVISION
30 ROCKEFELLER PLAZA NEW YORK 20, NEW YORK

HYDROCONE Crusher Gives You All These Benefits



1 **WOBBLE PLATE FEEDER** distributes feed evenly. Standard on crushers with fine crushing chambers; optional on others.

2 **SPIDER BEARINGS** are readily replaceable. Sleeve type in larger units; ball and socket bearings in the smaller machines. Lubricant is retained by an effective seal encircling the main shaft.

3 **FULLY AUTOMATIC** lubricating and oil conditioning system.

4 **SHORT HEAVY** *Hydrocone* crusher shaft has "cold-worked" finish, producing a high quality bearing surface.

5 **TOP SHELL AND SPIDER** cast in one piece. Can be easily removed.

6 **THREE TYPES** of crushing chambers available: Fine, Intermediate and Coarse, depending on the application.

7 **ONE-PIECE** inner and outer crushing surfaces are self-locking. Zincing of mantles not required on the 48-in. and smaller machines.

8 **RUBBER COMPRESSION MOUNTINGS** isolate vibration from supporting structure, eliminate need for massive foundations.

9 **ENCLOSED RING TYPE DUST SEAL** — A plastic ring impregnated with lubricant and held in place by a retaining ring. Dust is sealed from crusher eccentric by contact of the plastic ring with the outer periphery of the dust collar.

10 **BRONZE ECCENTRIC SLEEVE** is easily changeable in the field. Various eccentric throws may be obtained through the use of different sleeves, adding to the versatility of the *Hydrocone* crusher.

11 **THREE-PIECE** step bearing supports the main shaft on the hydraulic piston. *Hydrocone* crushers are designed to withstand crushing pressures much greater than those encountered in actual service.

12 **BEVEL PINION AND GEAR** are accurately cut . . . provide smooth operation and long life. Spiral bevel gears on the larger crushers.

AND — MOST IMPORTANT — *Hydrocone* crusher offers you *hydraulic control* of product size! Push-button operation on larger crushers; hand crank adjustment on smaller machines. An Automatic Reset protects crusher from tramp iron.

Capacities 10 to 1000 tph; sizes up to 84-in. diameter cone. For more facts, contact the A-C representative in your area, or write Allis-Chalmers, Milwaukee 1, Wis., for **Bulletin 07B7145B.**

A-3128

ALLIS-CHALMERS

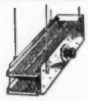
Texrope and *Hydrocone* are Allis-Chalmers trademarks.

Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

Motors

Controls

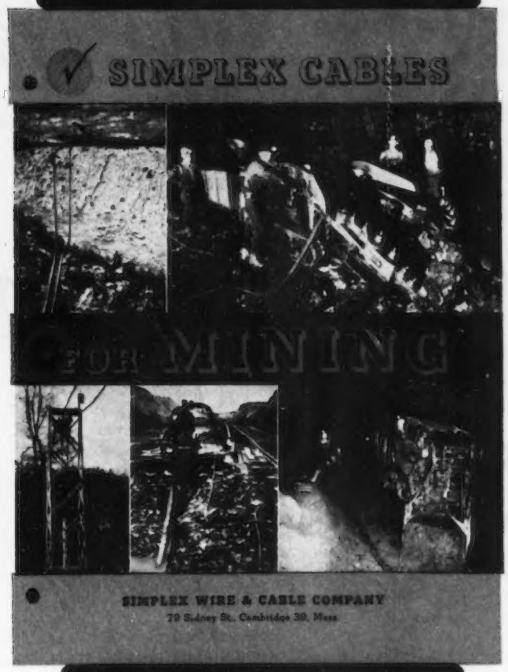
Texrope Drives


Vibrating Screens

Jaw Crushers

Kilns, Coolers, Dryers

THIS CATALOG *Tells All*



Here is a catalog that's different. You will want it for reference. It is written for mining people like yourselves and describes the many kinds of insulated wires and cables that are used in mining. The catalog tells about Borehole and Shaft Cables, Loading Machine Cables and Drill Cords, Telephone Cables, and Shovel Cables.

Besides the illustrations and descriptions of cables, the catalog gives information on splicing and on cable selection.

Want one? We will gladly send it. Simply fill in the coupon and return it to us.

SIMPLEX

WIRES AND CABLES

SIMPLEX WIRE & CABLE CO.

79 Sidney St., Cambridge 39, Massachusetts

SIMPLEX WIRE & CABLE CO.
79 SIDNEY ST., CAMBRIDGE 39, MASS.

GENTLEMEN: PLEASE SEND CATALOG 1008 TO:

NAME_____ TITLE_____

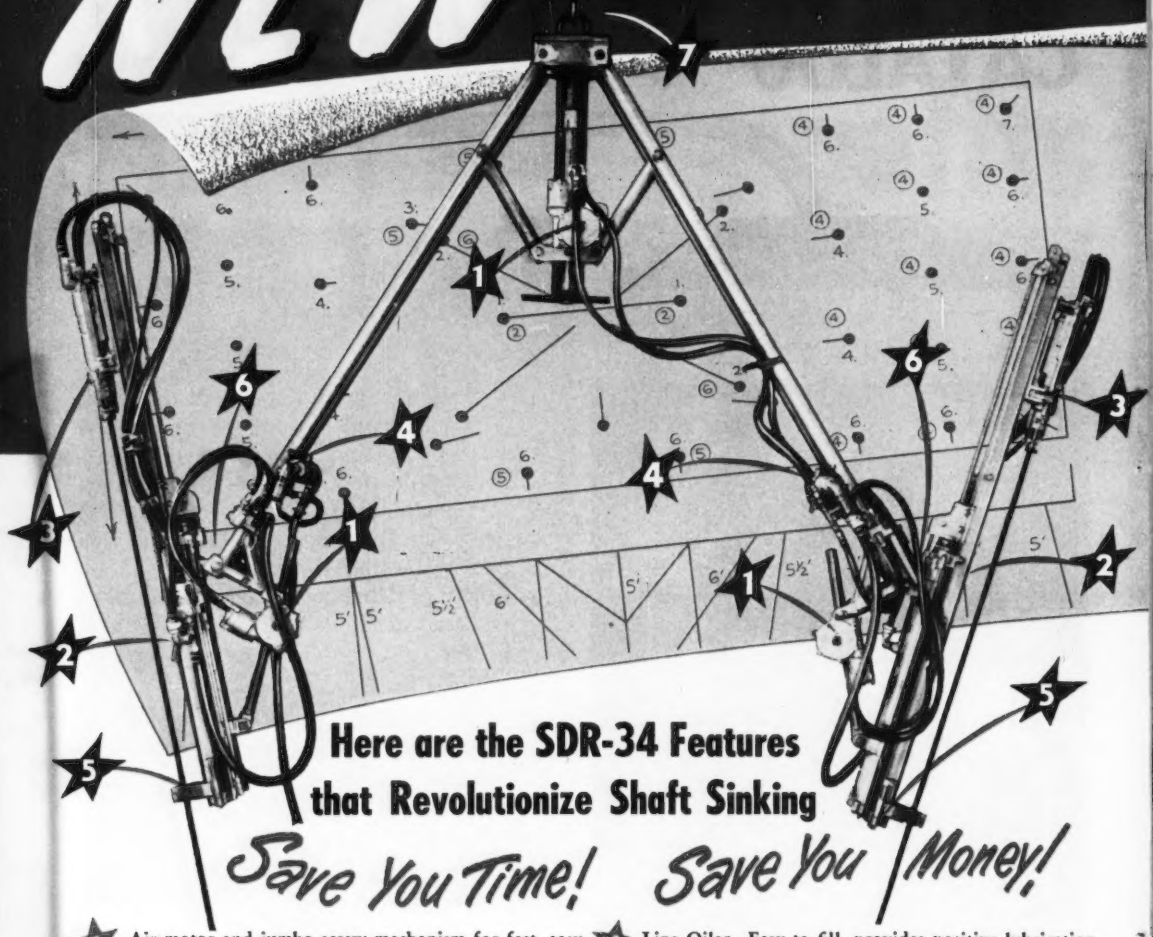
COMPANY_____

STREET_____

CITY_____ STATE_____

NEW

Le Roi CLEVELAND



Here are the SDR-34 Features that Revolutionize Shaft Sinking

Save You Time! Save You Money!

1. Air motor and jumbo screw mechanism for fast, easy adjustments. No slippage — good, positive set-up for complete drilling round.
2. Patented 2-to-1 air feed cylinder with chain drive. Positive feeding action for maximum drilling speed, minimum bit-wear. Six-foot changes eliminate steel handling for increased footage.
3. Model H23 Sinker. Weight 83 pounds. 3" bore provides plenty of rotation power and force of blow for fast drilling in all types of rock. Chucks for: 1" hex x 4¼", 1" or 1¼" round lug or popular quarter octagon sizes.
4. Line Oiler. Easy to fill, provides positive lubrication to the machines.
5. Drill Steel Centralizer. Opens and closes quickly. Makes hole collaring faster and safer.
6. Holes can be drilled at any angle. Adjustments are made quickly and easily by MDR air motors. You get better breakage for faster mucking.
7. Complete self-contained unit. Reduces handling time and effort. Speeds up shaft-sinking cycle for lower costs.

Specifications

LE ROI-CLEVELAND SDR-34 MULTIPLE DRILL SHAFT SINKER

Weight	1900 lbs.
Width in closed position	5'6"
Length	14'
DR34 air-shell travel	7'
DR34 air-shell steel change	6'
H23 chuck size	1" hex x 4¼ shank 1" or 1¼" round lug, or popular quarter octagon sizes

Can be furnished with 45 to 55 lb. Le Roi Cleveland H10 DR Drills—and for extremely hard rock conditions either the 3½-inch bore D-25 Drifter or the 4-inch bore D-14 Drifter.

SDR-34 Shaft Sinker

Drills 42-hole round in only 1/3 the time

required by two 55-lb sinker drills

Complete self-contained rig revolutionizes shaft sinking — speeds drilling — reduces steel handling — cuts costs!

HERE'S an example of how the new SDR-34 rig takes the headaches out of shaft sinking:

On a recent shaft job, the SDR-34 unit drilled out a 42-hole round (each hole 6 ft. deep) in less than an hour. On the same job it took two 55-lb. hand-held drills (3 steel changes) over three and a half hours to drill out this 42-hole round.

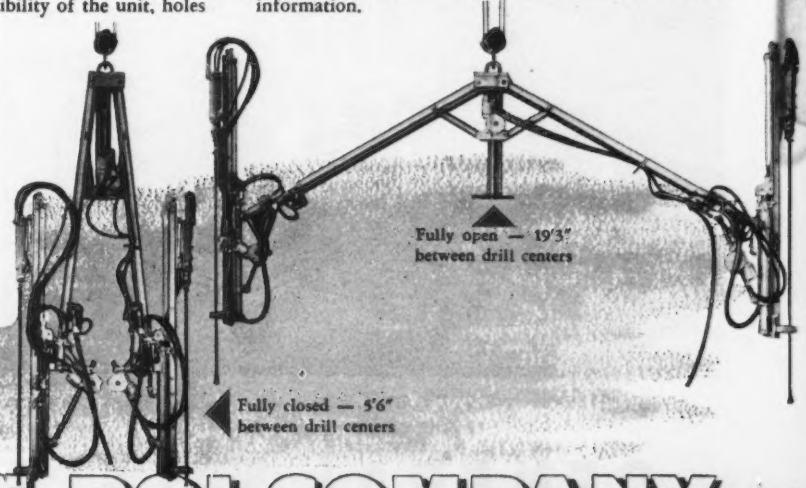
Obviously, savings such as this in drilling time do much to cut shaft sinking costs.

Moreover, because of the flexibility of the unit, holes can be drilled in the proper location and at the right angles to insure breakage for faster mucking. Again, you save!

Operators are less tired at the end of the shift, too. Using six-foot steels with tungsten carbide bits eliminates extra steel handling. And centrally located controls make the drill runner's job just that much easier.

Simplify your next shaft-sinking job with the SDR-34 and watch your costs drop! Write today for additional information.

The SDR-34 is a self-contained unit consisting of two famous Le Roi-Cleveland air-feed shells with two well known and popular Cleveland drills, air and water hoses, line oilers, drill-steel centralizers. Self-contained feature allows it to be dropped or withdrawn from shaft as a unit. Saves handling time. Gets round started faster for lower costs. MDR air motors make positioning fast, and easy — control arm-spread and drill angle through famous mine-jumbo screw mechanism.



LE ROI COMPANY

RD-29

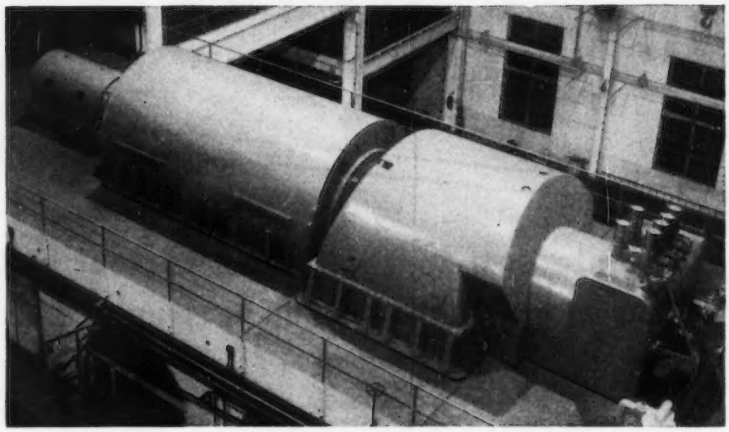
CLEVELAND DIVISION • *Manufacturers of* CLEVELAND ROCK DRILLS

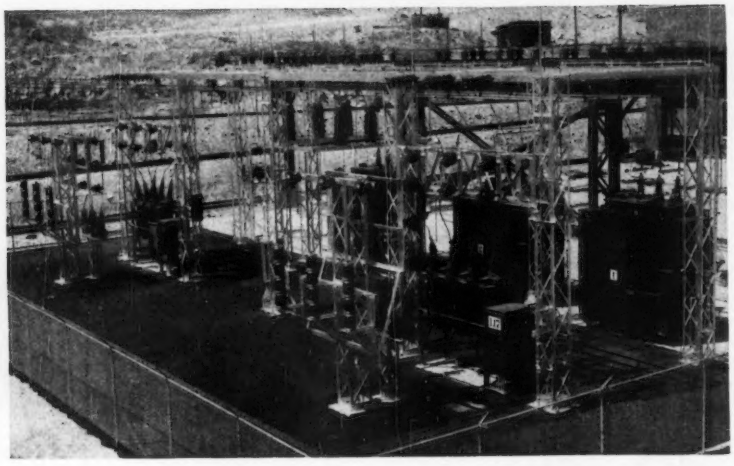
12500 Berea Road, Cleveland 11, Ohio

Birmingham • Butte • Denver • El Paso • Ironwood • New York • Philadelphia • Phoenix • Portland • Salt Lake • St. Louis • San Carlos • Tulsa • Wallace

Powered for low-cost high-tonnage refining!

1 Typical of the mining industry's increasing electrification to handle high tonnages at low cost is this new copper refinery at Garfield, Utah, which has a capacity of 12,000 tons of refined copper per month, with provision for expansion to 16,000 tons. Power for the refinery and other operations comes from Kennecott's power station, where three G-E steam turbine-generators (two of 25,000 kw each, plus the 50,000-kw unit shown here) generate 13.8-kv power which is stepped up to 44 kv for transmission.



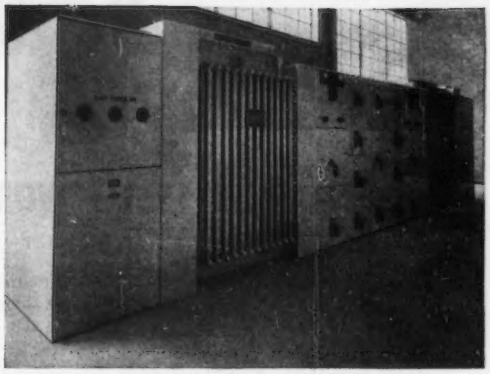


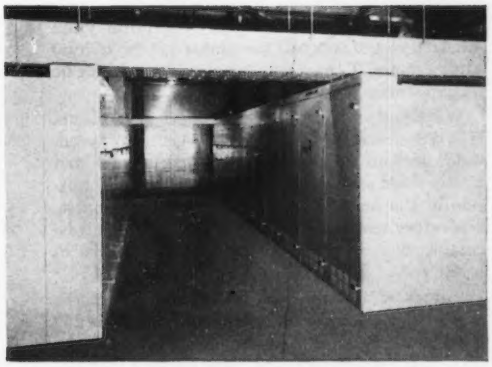
2 At the refinery, three miles away from the power plant, incoming 44-kv power is stepped down to 13.8 kv at this G-E package substation. Completely co-ordinated, it includes an outdoor steel switching structure, three 7500/9375-kva power transformers (with provision for addition of a fourth) and necessary metal-clad switchgear. G-E package substations, made in many standard combinations to fit all mining-industry needs, come in factory-built sections ready to install. They simplify ordering, save engineering time, speed installation, cut costs.

GENERAL ELECTRIC

660-20

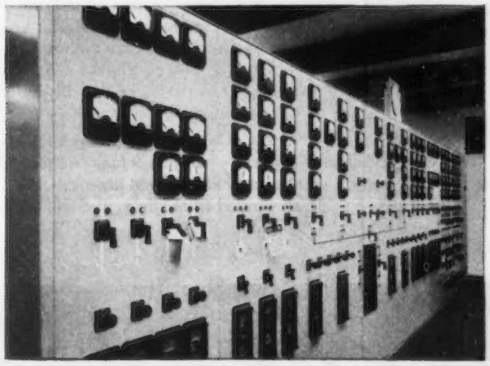
In its new electrolytic refinery, Kennecott Copper Corporation uses this General Electric generation, conversion, and distribution equipment to help maintain production continuity





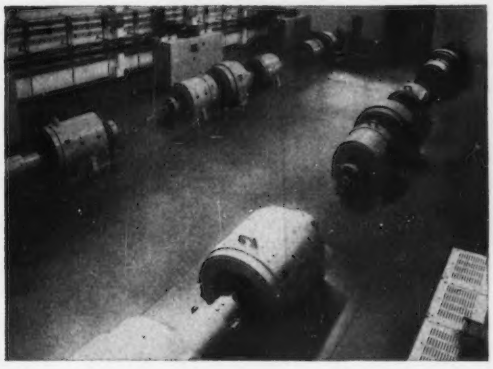
5 Four G-E 1500-kva double ended load-center substations (one shown) step down voltage from 13,800 to 480 and provide distribution at centers of load to reduce power losses.

6 This G-E panel — controlling package substation, a-c switchgear, and d-c power for electrolytic cell lines — helps centralize and co-ordinate plant operations.



3 Inside the refinery, protecting all 13.8-kv feeders and personnel as well, is this G-E metal-clad switchgear that provides flexibility for future load changes.

4 A-c is converted to d-c for electrolytic cell lines by six G-E motor-generator sets, each including a 2900-hp synchronous motor and two 1000-kw, 125-volt d-c generators.



CO-ORDINATED POWER SYSTEMS

for the Mining Industry

Whatever *your* mining or processing problem, a good man to know is the mining industry specialist in your nearby G-E office. Ask him about power-system equipment for *your* plant to protect service continuity, help boost production, cut costs.
Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

Carilloy "T" Steel greatly

ON THE MARION 5561 — WORLD'S LARGEST POWER SHOVEL

THE mammoth 45 cubic yard bucket on Hanna's "Groundhog" is moving more than a million yards of overburden every month. Despite the exceptional punishment it receives, the U·S·S CARILLOY T-Steel lip-plate has already been in service much longer than any steel previously used.

Further, the higher physical properties of T-Steel have made possible design changes which are now under way and which should greatly extend lip life beyond present construction.

Here's what Hanna Coal Company says, as owner and operator, "The lip of this bucket (made from 4½" CARILLOY T-Steel) is one of the most critical sections and it takes a great deal of punishment when loading the rock strata we have at this location. At Marion Power Shovel Co., we have a *50-yard* bucket on order. It will be built almost entirely of T-Steel . . ."

In this new bucket, CARILLOY T-Steel will increase capacity 5 yards — almost *9 tons* — by cutting weight without any sacrifice in strength. And because it can be welded *in the field*, T-Steel construction makes it unnecessary to shut the shovel down for the many hours formerly required for shop repairs.

CARILLOY T-Steel, a product of United States Steel research, is a *low carbon* alloy steel, heat-treated with great precision. Minimum yield strength is 100,000 psi (for plates ¼" to 2" inc.) Furthermore, T-Steel will remain ductile at arctic temperatures—*even after welding.*

Welding does not lower the strength of the plate. If AWS electrodes E-12015 or E-12016 are used, welds remain 100% strong . . . both butt and fillet-welded specimens will break completely outside of the heat-affected area. As for toughness, laboratory tests have proved that, even after gas-cutting, T-Steel can be bent at more than 100°F. below zero.

CARILLOY T-Steel is normally produced in the forms of plates and bars. Nominal hardness is 250 Brinell, although 321 minimum Brinell can be furnished for abrasive conditions where a combination of high hardness, toughness and weldability is essential.

increases lip-plate life

MECHANICAL PROPERTIES—U·S·S Carilloy T-1 Steel Plates can be furnished Heat Treated to the following mechanical properties:

	Thickness ¼" to 2" incl.	Thickness Over 2" to 4" incl.	Thickness Over 4" to 6" incl.
Yield Strength, .2% Offset (min.)	100,000 psi	90,000 psi	90,000 psi
Tensile Strength (min.)	115,000 psi	105,000 psi	105,000 psi
Elongation in 2", % (min.)	18	17	16
Reduction of Area, % (min.)	55	50	45

	Thickness ⅛" to ½" incl.	Thickness Over ½" to 1" incl.	Thickness Over 1" to 2" incl.
Cold Bend	180°D=1t	180°D=2t	180°D=3t

(Testing in accord with A.S.T.M. recommended practices.)

UNITED STATES STEEL COMPANY, PITTSBURGH

COLUMBIA STEEL COMPANY, SAN FRANCISCO • TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM

UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS **Carilloy Steels**

ELECTRIC FURNACE OR OPEN HEARTH • COMPLETE PRODUCTION FACILITIES IN CHICAGO AND PITTSBURGH

UNITED STATES STEEL

A 109-hole blast without mats!

. . . A **ROCKMASTER "16"** blast, of course

This was tough blasting, all right! Smack in the middle of Bend, Oregon and hemmed in by homes, a fire house, a gas station, and the main building of the hospital to which J. H. Wise & Son, Inc. was building an addition.

In Bend, every small excavation must be blasted out of lava rock—and even small blasts under protective mats have often meant broken windows and a flood of complaints. So, "You'll break every window in town" was the natural reaction to the plan of the sub-contractor, Morrison-Knudson Co., to fire a 109-hole blast.

At the suggestion of the Atlas Sales Representative, the 109 holes were drilled on 4-foot centers, employing a ROCKMASTER "16" pattern using up to the tenth milli-second delay detonator interval. The shot was fired without mats, but not a single window was even rattled.

Local contractors were amazed not only by the lack of noise and vibration and the exceptional control over throw, but by the excellent fragmentation. Perhaps the best testimonial to ROCKMASTER "16" came from a fireman on duty across the street who said he was upstairs at the time and didn't realize the blast had been fired.

This is typical of the results blasters are getting with the ROCKMASTER "16" Blasting System in construction, stripping, mining, and quarrying . . . on the surface and underground. Perhaps, this milli-second delay blasting *system* is the answer to *your* blasting problems. So send for your copy of the ROCKMASTER "16" booklet—it's *free*.

ROCKMASTER: Reg. U.S. Pat. Off.

ATLAS EXPLOSIVES *"Everything for Blasting"*

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*

Bagdad Copper Corporation's Arizona plant chose Gates Vulco Rope Drives for these big Ball Mills because of the proven ability of Gates Vulco-Ropes to handle this rugged service.

This Simple Test Tells WHY the Concave Sides of Gates Vulco Ropes Mean *Longer Belt Life!*

Prove this *yourself*—in two minutes' time.

Take any V-belt that has *straight* sides. *Bend* that V-belt while you grip its sides between your fingers and your thumb. You will *feel* the sides of the belt *bulge out*—as shown in figure 1-A, below.

Clearly, that outbulge forces the sides of the belt to press *unevenly* against the V-pulley—and this concentrates the *wear* where the bulge is greatest.

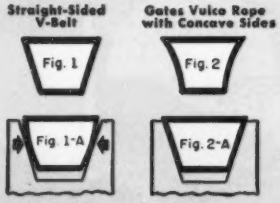
Now, make the same test with the belt that is built with the Concave Sides—the Gates Vulco Rope.

Figures 2 and 2-A show clearly what happens when you bend a Vulco Rope. Instead of *bulging*, the precisely engineered Concave Sides merely *fill out* and become perfectly straight. There is no side-bulge. This belt, when bent, precisely fits its sheave groove.

Because there is *no bulging*, the sides of the Gates Vulco Rope always grip the *full* face of the V-pulley *evenly* and therefore wear *uniformly*—resulting in *longer belt life* and *lower belt costs for you.*

Only V-belts made by Gates are built with concave sides. Whenever you buy V-belts, be sure that you get the V-belt with the Concave Sides—The Gates Vulco Rope!

What Happens When a V-Belt Bends



How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear At Point Shown by Arrows.

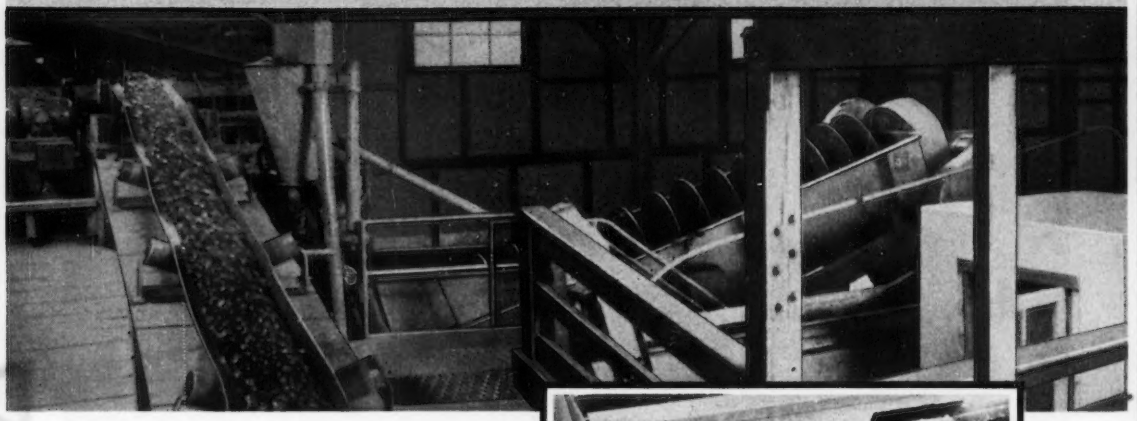
The Concave Sides Fill Out to a Precise Fit in the Sheave-Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley—Uniform Wear—Longer Life!

CS-511

THE GATES RUBBER COMPANY
DENVER, U. S. A.
The World's Largest Makers of V-Belts

Gates VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U.S. and 71 Foreign Countries

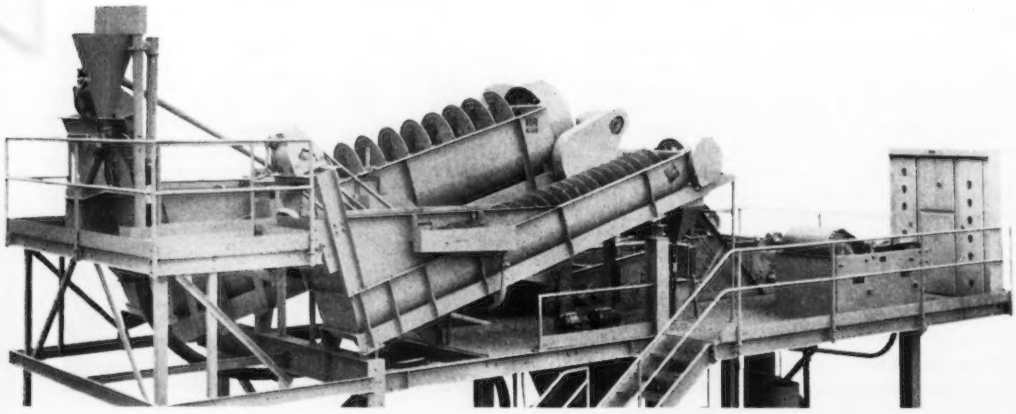
THREE PRODUCT HMS SEPARATION..



● These mill pictures were taken of an Akins Separator designed to make a single-stage three-product separation. In the close-up of the pool, note the positive movement of float particles toward the corner near the float overflow port. Outside this picture is the middlings overflow port, where particles of intermediate specific gravity are removed. At the upper end of the spiral, sink particles of the highest specific gravity are discharged from the vessel.

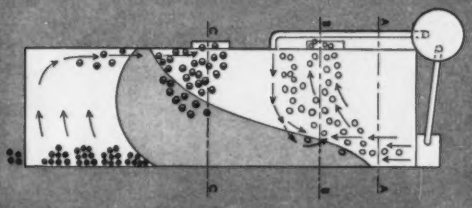
Sweco Factory-Built Plant Ready for Packing and Shipment

The Akins Separator is the heart of the Sweco Factory Built HMS Plant about which the mill above was constructed. Here, in one compact structure, is all the basic equipment for a Heavy Media operation with feed capacity of up to 300 tph. It is the only factory built plant capable of making a middling separation.



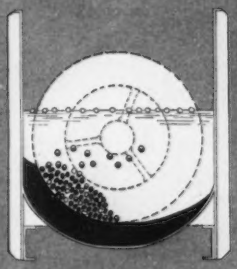
..Looks Like This

A diagramatic version of this patented separation shows the way in which feed particles travel through the pool of the Akins. Results are higher grade concentrates, leaner tailings, and operating economies impossible with other separating vessels.



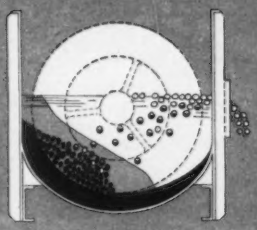
Section A-A, deepest part of pool with float and middlings partially entrapped in sink during initial plunge.

SECTION A-A



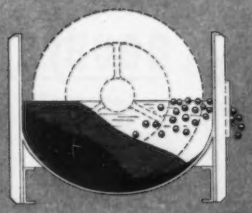
Section B-B, float overflow port between two feed sources, float particles have worked free of sink through spiral action and increasing density in shaded area of pool.

SECTION B-B



Section C-C, middlings overflow port near shallow end of pool, or point of greatest density where separating action is completed.

SECTION C-C



Whether you are after a separate middling product as such, or want only a clean separation between concentrate and tailing, Akins three-product separation is the only method of single stage operation capable of giving you all these advantages. Ask for operating data and estimates on your application.

REPRESENTATIVES

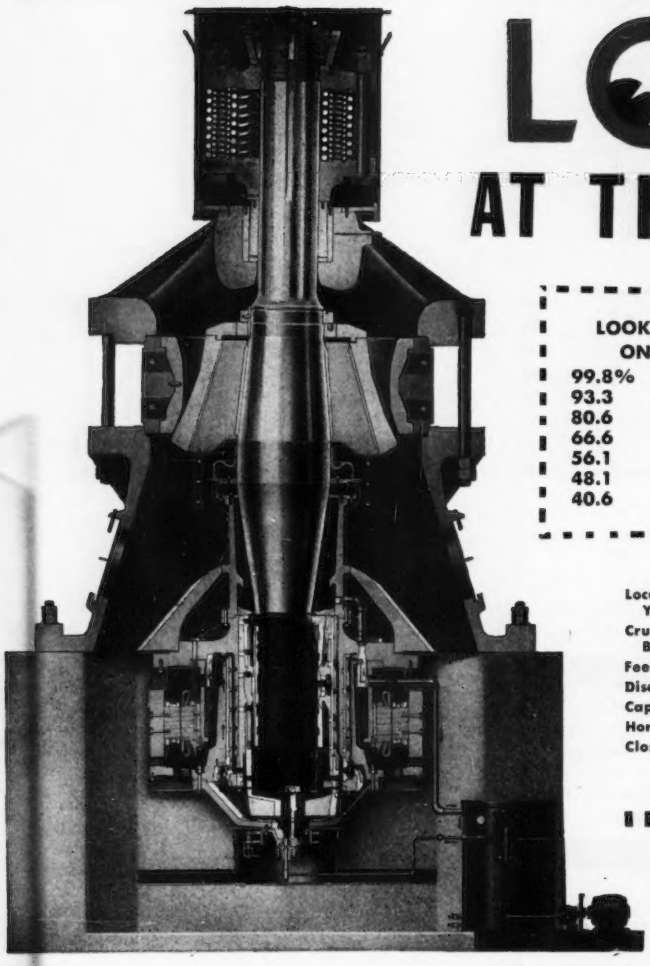
Canadian Locomotive Co., Ltd., Kingston, Ont., Can., Licensed Manufacturer—Head, Wrightson & Co., Ltd., Stockton on Tees, Eng., Licensed Manufacturer—John Carruthers & Co. (Pty.) Ltd., Sydney, Aus., Licensed Manufacturer—Head, Wrightson & Co., S. A., (Pty.) Ltd., Johannesburg, Licensed Manufacturer—Edw. J. Nell Co., Manila, P. I., Sales Agents—Wright Bros., Credit Foncier Bldg., Vancouver, British Columbia, Sales Agents.

COLORADO IRON WORKS CO.

Ninety Years' Service to Mining
1860 — 1950

COLORADO IRON WORKS CO.

DENVER 2, COLORADO



LOOK AT THIS PROOF!

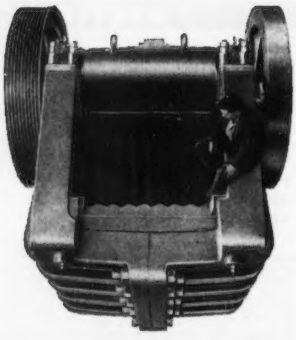
LOOK AT THESE GRADATION FIGURES ON CLOSED CIRCUIT OPERATION			
99.8%	Minus	3	MESH
93.3	"	4	"
80.6	"	6	"
66.6	"	8	"
56.1	"	10	"
48.1	"	14	"
40.6	"	20	"

Location: Nationally known Mining Co. in New York State
Crushers: Four No. 37½ Kennedy type "S" Roller Bearing Gyratory Crushers
Feed Opening: 6¼"; **Diameter of Head:** 3 Feet
Discharge Setting: 7/32" Closed Side at Head
Capacity Each Crusher: 56 Tons Per Hour
Horsepower Each Crusher: 48HP.
Closed Circuit Operation

LOOK

DOUBLE CRUSHING LIFE

Look at POWER SAVING in the "KVS" Swing Jaw Crusher, The STATIONARY jaw now carries 50% of the crushing load. Result—you SAVE POWER in crushing. We looked into MAINTENANCE too. The swing jaw is now ALL IN ONE PIECE, except for the crushing plate. That's removable. Note also—Swing and Stationary jaws are INTERCHANGEABLE, and reversible end for end. Look to that for DOUBLE jaw-crushing life!

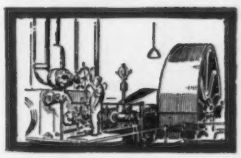


LOOK TO "KVS" FOR PRODUCTS

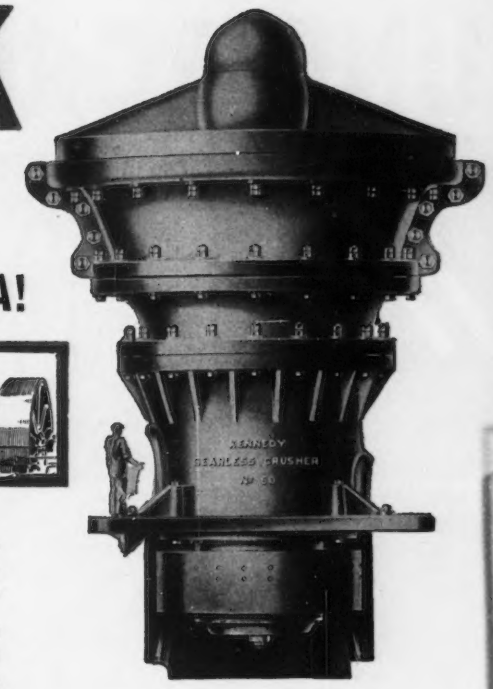
LOOK

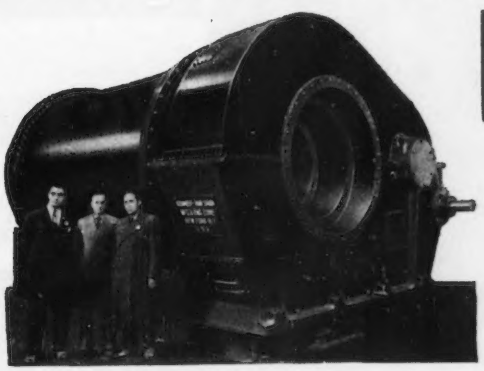
HOW YOU SAVE

BY AN OLD FASHIONED IDEA!



Look at how the big whirling flywheel or pulley of an old Corliss Engine developed KINETIC ENERGY! That meant added FREE power! Look at the BIG Pulley in the "KVS" Gearless, too! It revolves at 3,500 ft. per minute—creates EXTRA crushing power you get for nothing! The 11 ton pulley (used in a "KVS" Gearless Crusher weighing 400,000 lbs.) turns so easily you can turn it with TWO FINGERS! Look here, man—more CRUSHING with LESS POWER, less vibration and less NOISE, too, has put the "KVS" Gearless way out in front and kept it there!





LOOK *and be*

$6,000 *richer!*

Planning to install a tube or ball mill? SAVE up to $6,000 on a "KVS" 10 ft. diameter Mill with integral gear drive by using a SYNCHRONOUS MOTOR DIRECT CONNECTED to driving shaft carried in roller bearings that CANNOT be misaligned or set wrong. Pinion shaft runs at about 600 r.p.m. Pinion shafts in other mills run at about 180 r.p.m. "KVS" trunnions on large sized tube and ball mills CARRIED ON OIL. Bearing never wears out, uses little power. All gears and bearings automatically oil sprayed before mill is started (design pat'd). In 15 years on this type mill no "KVS" gears or pinions have worn out.

LOOK at the "KVS" Bulletins. Fully describe all of above. Just ask for them.

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION

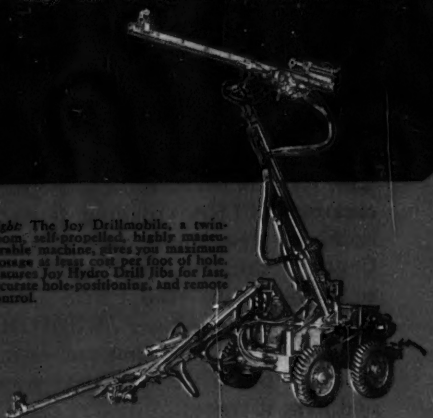
WITHOUT TROUBLE

2 PARK AVE., NEW YORK 16, N. Y.

FACTORIES:
DANVILLE, PA., U.S.A.
CANADA, ENGLAND, FRANCE, AUSTRALIA

UNDERGROUND, OR . . .

IT'S JOY EQUIPMENT

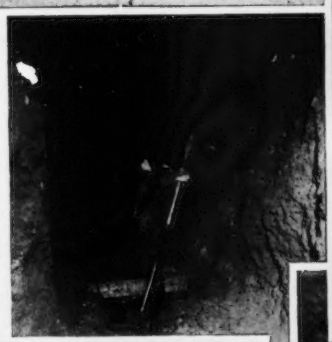


Right: The Joy Drillmobile, a twin-boom, self-propelled, highly maneuverable machine, gives you maximum footage at least cost per foot of hole. Features Joy Hydro Drill Jibs for fast, accurate hole-positioning, and remote control.

Above: For high-production loading and haulage of rock and ore, Joy teams of trackless loaders and electric or diesel shuttle cars get the call underground.

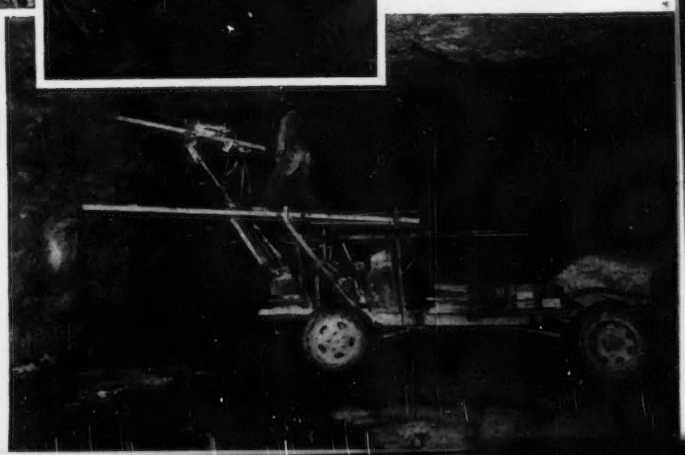
Right: Complete range of Joy Stopers includes the new S-91T, with telescopic feed. Requires fewer steel changes, gives more time for drilling.

Below: Joy Wagon Drill specially adapted to drill at any height from toe-holes to horizontals 9' high.



Left: The Joy HS-15 high speed drill for underground blast holes, or core drilling to 500'. Compact and easy handling, with "in-line" vibrationless drive.

Below: Joy Hydro Drill Jibs are versatile units; can be mounted as required to suit individual needs. This truck-mounted Jib is an example.

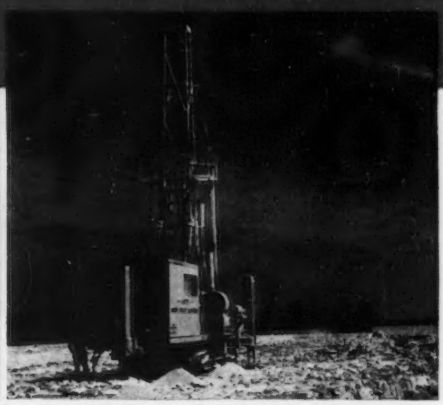


. . . ON THE SURFACE

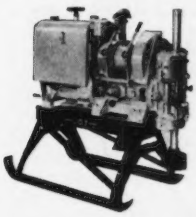
FOR GREATER TONNAGE FOR LOWER COSTS

Above: Joy builds a complete line of "Silver Streak" Hand Tools, cadmium-plated for rust protection and easier running in.

Above: Joy Wagon Drills (Medium and Lightweight models) are easily maneuvered units with positive locking brakes for quick set-ups and balanced drilling on any terrain.



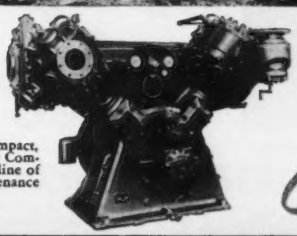
Above: Joy Champion Rotary Drills set absolutely new standards in high-speed, economical blast hole drilling, far outperforming all others. Built in two self-propelled models, for diesel, gasoline engine or electric motor drive.



Above: Joy Core Drills range in capacity from 250 to 1750 feet of 1½" hole. Screw feed or hydraulic types—gasoline, diesel, air or electric drive.

Left above: Joy's popular Series 80 Portable Compressors, with the famous "Econo-Miser" load control, are built in seven sizes, from 60 to 630 CFM.

Above: Joy Hydro Drill Jibs are readily adaptable to truck-mounting, etc. for secondary drilling or toe-holes in quarries or open-cut mining.



Right: Joy pioneered the compact, modern "package-type" Air Compressor—offers a complete line of highly efficient, low maintenance airplants up to 3656 CFM.

Consult a Joy Engineer

W&D M-3363

JOY MANUFACTURING COMPANY

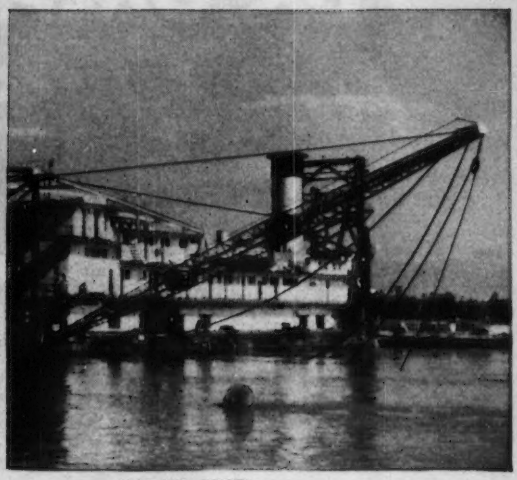
GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

FOR JOBS LIKE THESE...

You've got to have a rope with guts

HIGH, WIDE AND HANDSOME. Quarries need wire rope that will run fast, support tremendous weight. This photograph shows TIGER BRAND Wire Rope used for derrick and mast guys, and hoisting ropes, in a nationally-known quarry.



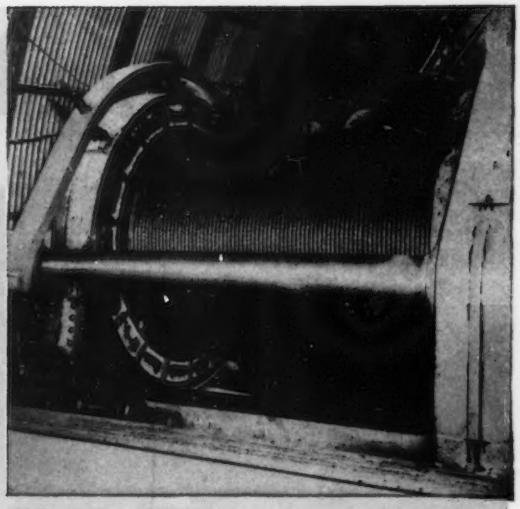
WET AND MUCKY. TIGER BRAND Wire Rope furnishes the muscles for this big Mississippi dredge. Constantly in and out of water . . . subjected to extreme loads . . . TIGER BRAND delivers economical heavy-duty service that pays off in fewer rope replacements.

A ROPE'S TOUGHEST DIGGING JOB. Dust and grit spell short life for inferior rope—if it's used in strip mining. But you can count on TIGER BRAND Wire Rope to give matchless performance under the toughest operating conditions.

TIGER WIRE ROPE SLINGS

We can furnish a complete line of 8, 6, 4-part and laid slings as well as all standard and special wire rope fittings. Choose from our standard selection or, if you have a special problem, we'll make special slings to your specifications. Write for our free booklet, "American Tiger Wire Rope Slings."

OUT GOES THE OVERBURDEN. Stripping overburden usually means high shock stresses on the rope. TIGER BRAND Wire Rope—made in the widest variety of styles—is available to meet unusual conditions of shock . . . abrasion . . . high loads.



READY FOR A WORKOUT. TIGER BRAND Wire Rope has the flexibility to withstand constant coiling and uncoiling. When properly lubricated and maintained, TIGER BRAND Wire Rope will give you dollar for dollar service that can't be beat by any other wire rope.

FOR HIGH STRENGTH, GREAT FLEXIBILITY AND A COMPLETE RANGE OF SIZES AND STYLES—USE

TIGER BRAND WIRE ROPE

Judge it by the jobs it handles!

Most premature rope failures can be traced to improper selection, maintenance or installation.

Your TIGER BRAND field service engineer can help you with all these problems. A skilled engineer, he has access to a tremendous file of case histories. He knows how to pick the *best* kind of wire rope for your own job—the type of core, the kind of steel, the construction, the lay and the finish—all things that must be considered for top performance.

Your TIGER BRAND field service engineer will do more than help you select the rope. He'll show you how to use it most effectively with your running equipment. He might, for example, suggest that you use:

MANGANESE STEEL SHEAVES TO INCREASE ROPE LIFE

Soft steel sheaves can cause trouble. Tiny slivers of metal become imbedded in the rope and "grind" it until it fails. Furthermore, the rope will cause corrugations in the sheave. In turn, these corrugations can ruin the rope that caused them. Manganese steel sheaves actually harden and polish themselves under severe pressure and friction. So they continuously present a smooth surface to the rope—and lengthen its life.

If you have a special application that's tough on wire rope, get in touch with your TIGER BRAND field service engineer. Meanwhile, you'll find a wealth of knowledge in our information-packed handbook, "American TIGER BRAND Wire Rope." Write for it today.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT CO., NEW YORK

USS TRADE MARK

AMERICAN TIGER BRAND WIRE ROPE

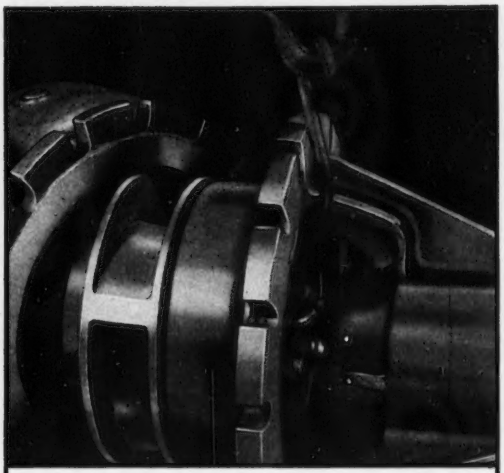
Excellay Preformed

UNITED STATES STEEL

Remove Rotating Element in 5 Minutes!

ALLIS-CHALMERS SOLIDS HANDLING PUMP

1. Remove Casing Bolts lift and disconnect drive. Just loosen bolts and bolt assembly from slot. Bolt, nut and washers are still connected for easy reassembly.



2. Swing Out Rotating Element. Neither suction nor discharge piping need be disturbed. All wearing parts are fully accessible for inspection or servicing.

THE PUMP IS BACK IN SERVICE IN LESS THAN A HALF HOUR

QUICK, EASY SERVICE AND LONG RUNS between servicings are the two things operators want most in solids handling pumps. You can see for yourself how quick and easy service is with an Allis-Chalmers Solids Handling pump.

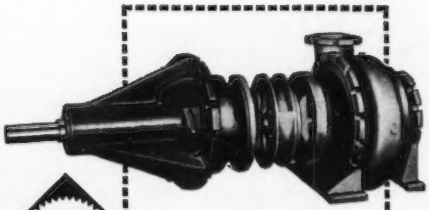
You get long life, too, because Allis-Chalmers Solids Handling Pumps are made of special hard *Allisite* alloy . . . because they have thick sections and heavy parts throughout . . . and because they are application engineered by specialists who know solids handling problems and how to solve them.

Get complete information on Allis-Chalmers Solids Handling pumps from your nearest Allis-Chalmers Sales Office. Or write for Bulletin 08B6381.

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE, WIS.

A-3216

Allisite is an Allis-Chalmers trademark.



ONLY FIVE WEARING PARTS

Shaft sleeve, impeller, casing, two wear plates. All easy to handle and easy to replace.

ALLIS-CHALMERS

Look Into this Traylor TC Gyratory for efficient, large volume, primary crushing

NEARLY 22 FEET across the *non-weaving, straight line bar type spider* of this 60 inch Traylor TC! Six smaller sizes, down to 20 inch, are proportionately just as rugged . . . have feed openings of the same generous proportions.

YES, THAT'S THE FAMOUS, exclusive Traylor BELL HEAD and CURVED CONCAVES combination that nips larger rock . . . crushes it more uniformly . . . saves power, time and maintenance expense.

UPPER AND LOWER SHELLS are kept as simple as possible. Transportation and installation problems control the number of sections of each. The Traylor method of assembly assures single casting rigidity.

THE *one* crusher which brings *all* of the advantages of gyratory crushing to primary operations is the Traylor TC Gyratory. In it *alone* are found the Traylor *bell head* and *curved concaves* which have become the by-word of gyratory crushing performance and economy. Eccentric and counter shaft bearings are protected from excessive wear by the simple, effective Traylor dust seal and a water-cooled, forced-flow oil lubricating system. If you need a large volume primary crusher to satisfy rising production demands, it will pay you to investigate a Traylor TC Gyratory today.

MAIL THIS COUPON
to get full details on a Traylor TC Gyratory

TRAYLOR ENGINEERING & MANUFACTURING CO.
314 MILL ST., ALLENTOWN, PA.

I would like to see how a Traylor TC Gyratory can increase the efficiency of my plant.

*Name*_____

*Company*_____

*Address*_____

SALES OFFICES: New York, N.Y.; Chicago, Ill., Los Angeles, Calif.
Canadian Mfrs: Canadian Vickers, Ltd, Montreal, P.Q.

Traylor

Rotary Kilns, Coolers and Dryers · Grinding Mills
Jaw, Reduction and Gyratory Crushers · Crushing Rolls

A "TRAYLOR" LEADS TO GREATER PROFITS

First and foremost, the Edison R-4 Cap Lamp is designed to give LIGHT . . . a never-failing flood of it, stepped up in intensity to meet the greater illumination needs of increasing mechanization. Because the miner's safety and the mine's production and profit are mutually dependent on unfailing and sufficient *light*, there can't be any compromise with this essential requirement.

The engineering refinements and service benefits of Edison R-4 lamps come as *plus* values to the basic function. Because both equipment and service structure are designed from an intimate knowledge of overall mining problems, gained in years of close cooperation with the mining field, there's something about the R-4 lamp that EVERYBODY likes . . .

MINE SAFETY APPLIANCES COMPANY

BRADDOCK, THOMAS AND MEADE STREETS . . PITTSBURGH 8, PA.

***At Your Service:* 48 BRANCH OFFICES in the UNITED STATES**

MINE SAFETY APPLIANCES CO. OF CANADA LIMITED • Toronto, Montreal, Calgary, Winnipeg, Vancouver, New Glasgow, N. S.

Representatives in Principal Cities in Mexico, Central and South America

CABLE ADDRESS: "MINSAF" PITTSBURGH

THE EDISON R-4

Throws NEW light on an old problem

PRESIDENT: "Our lamp costs under MSA's rental plan are not only reasonable . . . but they're *stable*. That's about the only item in our whole cost picture that we can be sure won't change."

ENGINEER: "We always want to include every possible improvement in any new lamp house . . . and the MSA man always makes an important contribution. He knows the ideas that work . . . and the ones that don't!"

SUPERINTENDENT: "The regular visits of the MSA man mean trouble free and dependable light and service."

FOREMAN: "With Edison lamps, a burned-out filament doesn't mean a lost shift for a man and a short crew for me. Edison's double filament bulb saves us hundreds of man-hours every year."

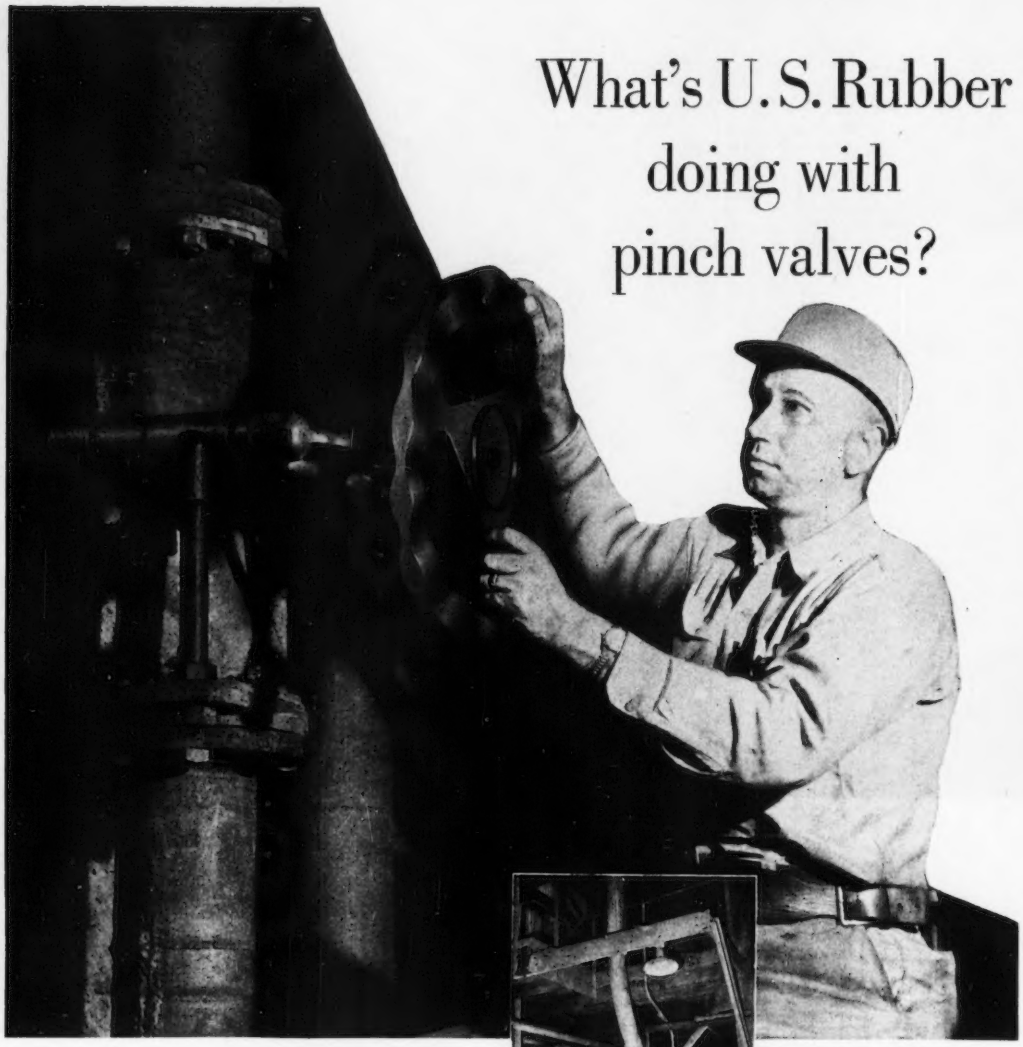
MAINTENANCE: "Edison equipment makes my job easier. Lamps are easy to service, and batteries last for years. And the MSA training course taught me how best to handle lamps and get the most out of them."

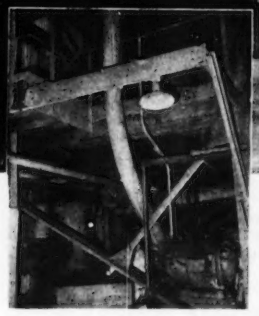
MINER: "My job, my production and my safety all depend on my light. I want equipment I can bank on . . . and I know that Edison lamps will always deliver."

WHEN YOU HAVE A SAFETY PROBLEM
MSA IS AT YOUR SERVICE.
OUR JOB IS TO HELP YOU.

MSA
SAFETY EQUIPMENT HEADQUARTERS

What's U.S. Rubber doing with pinch valves?





U.S. PILOT PINCH VALVE being adjusted by coal mine superintendent to control flow in preparation plant of large West Virginia mine. Mechanism is very compactly designed, can be refitted to new pinch valve bodies.

U.S. PILOT FLEXIBLE PIPE conveying sand and water in same preparation plant. Pipe is so flexible no elbows or short connections are needed. This particular pipe has been in service two and one half years so far, replacing a metal pipe which lasted only six months.

In many coal preparation plants U.S. Pilot Pinch Valves control the flow of water containing abrasives. In the chemical industry, they handle corrosive mixtures, acids, and solids. They serve the paper industry, the food and beverage industry.

Another "U.S." product invaluable in coal washing is U.S. Pilot Flexible Pipe. The one at right carries up to 10,000 tons of sand a day. Both Pilot Pinch Valves and Flexible Pipe safeguard equipment from mechanical strain caused by vibration, expansion, contraction and "water-hammer."

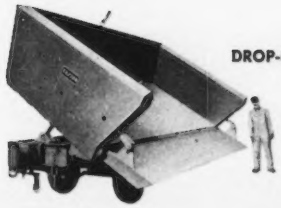
PRODUCTS OF

U.S. RUBBER

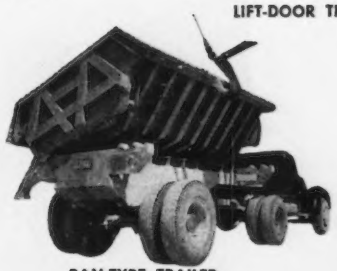
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

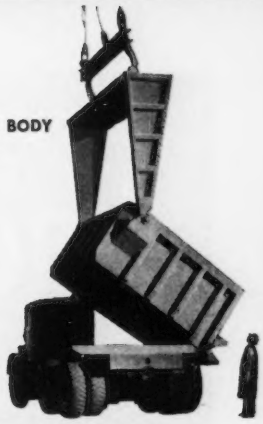
MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.



DROP-DOOR CAR



PAN-TYPE TRAILER



LIFT-DOOR TRUCK BODY

DROP-DOOR TRUCK BODY

PAN-TYPE CAR (PHOENIX)

DOUBLE-BOTTOM PAN-TYPE TRAILER

LIFT-DOOR TRAILER

PAN-TYPE TRUCK BODY

DOUBLE-BOTTOM DROP-DOOR TRAILER

What About Side-Dumps?

Experienced users say, "When side-dumps apply there is no reason to consider any other type of hauling equipment!"

Do the spectacular advantages of new, modern side-dumps apply to your hauling requirements? Is there an undiscovered opportunity to reduce your handling, increase your production, save hauling time and cut your hauling costs by switching to the *roll up, dump, and roll on* side-dump system?

Why not get the facts straight from headquarters — from EASTON side-dump engineers? With the right EASTON side-dump trailer or truck body teamed up with the truck chassis of your choice you've hit the winning combination. If it's cars, call EASTON, too! For complete information please direct your inquiry to the main sales office at:

EASTON CAR & CONSTRUCTION CO., EASTON, PA.

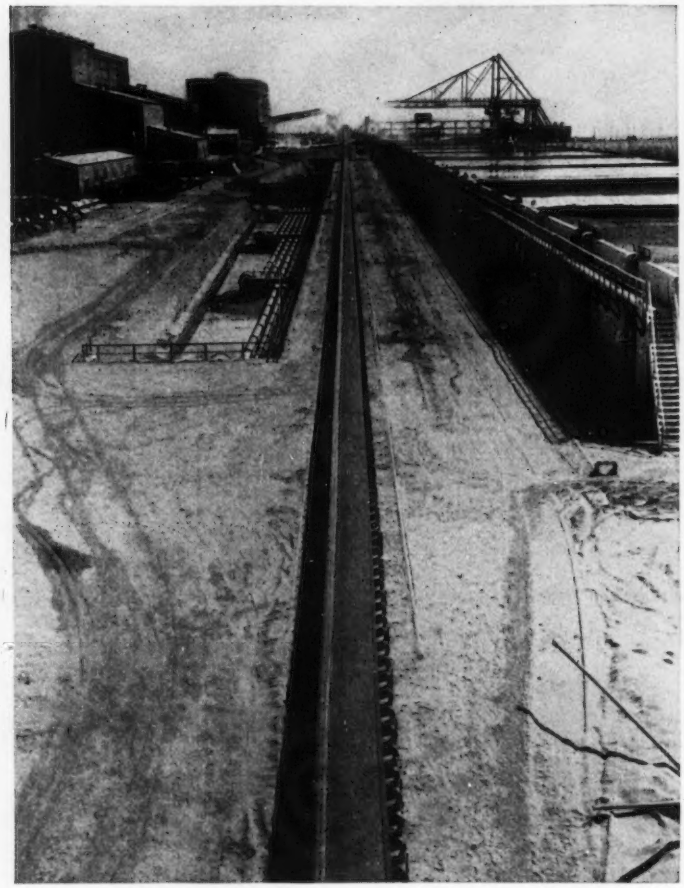
EASTON
Side-Dumps

CARS • TRUCK BODIES • TRAILERS

A Quarter of a Century—and

90 MILLION

Tons of Ore Prove the Superiority of this



S-A BELT CONVEYOR

Only a really heavy-duty conveyor carrier of rugged construction could take the punishment of twenty-five years of heavy ore handling . . . and still be good for many more years of service. As solid proof of this, the users who plan to extend their conveying system, specify that the new carriers be No. 444 S-A belt conveyors—"exactly the same as originally furnished."

In designing a system of this type—to meet stiff operating requirements—S-A engineers draw on their accumulated experience of fifty years in working with bulk materials handling problems. In addition they are free to specify the most suitable equipment for any job, as the S-A line of bulk conveying equipment is *complete*.

S-A engineers will gladly talk over your material handling with lower operating costs in mind. Write us today—no obligation.

MINING & PROCESSING OPERATIONS

Reduced and sized ore is moved by 60" wide S-A belt conveyor from crushing and screening house to travelling unloading bridge. The latter is a cross belt for depositing ore in a series of large vats parallel to the S-A belt conveyor. Material is reclaimed from the vats by an unloading bridge and grab bucket. The belt conveyor, illustrated, as well as other belt conveyors in the system, are equipped with S-A No. 444 live shaft carriers.

1901-1951

50 years experience with bulk handling

STEPHEN S-A ADAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

WATCH THE LOADS GO THROUGH—
SEE THE EARNINGS GO UP!

with Firestone TIRES

OPERATORS who keep a close eye on earnings know that they must keep tire costs at a minimum to have a profitable operation.

With Firestone Tires you can substantially reduce your costs because they are especially engineered — in tread and sidewall design . . . in bead and ply construction . . . in every minute detail — to fit your particular requirements.

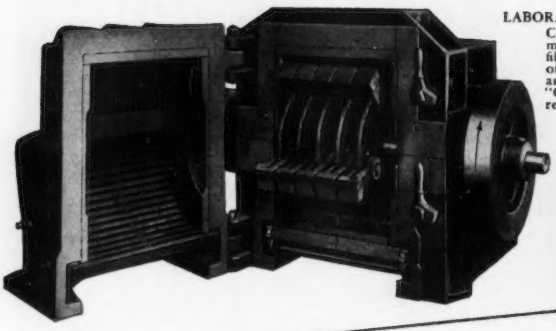
Whether it's strip mining, earth moving, or rock work, Firestone has a tire that will cut downtime and maintenance costs and keep men and equipment on the job.

See your nearby Firestone Dealer or Store. Let them look over your equipment and make an on-the-job analysis of your tire requirements. Let them show you how Firestone Off-The-Highway Tires will save YOU money.

WHEN ORDERING NEW EQUIPMENT SPECIFY FIRESTONE OFF-THE-HIGHWAY TIRES

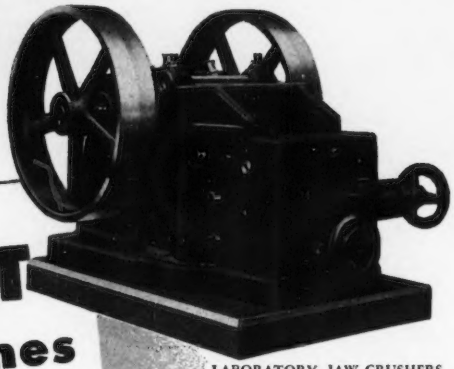
Listen to the Voice of Firestone on radio or television every Monday evening over NBC

Copyright, 1951, The Firestone Tire & Rubber Co.



LABORATORY SWING-SLEDGE MILLS

Capable of reducing soft, moderately hard and tough or fibrous materials to any degree of fineness between 1 in. and 20 mesh. The patented "Open-Door" feature permits ready accessibility for cleaning.



STURTEVANT

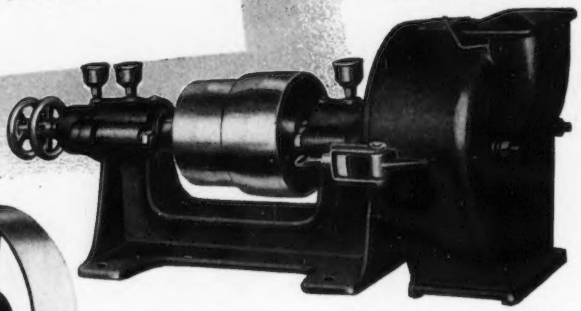
Laboratory Machines

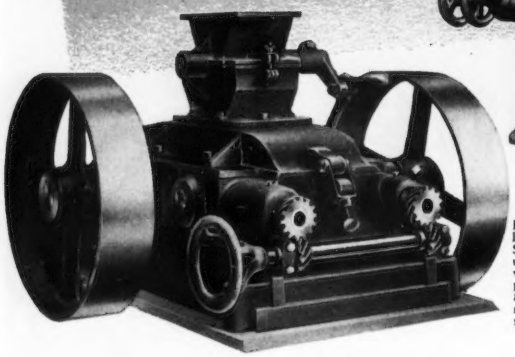
Assure Quality of Products

Fast - Economical - Accurate

LABORATORY JAW CRUSHERS

Special Roll Jaw action simplifies close regulation of the product with capacities varying from 300 or 400 lbs. per hour at finest settings, to 1000 or 2000 lbs. when opened for coarser work. Each part of the crusher is accessible for quick and easy cleaning.





LABORATORY CRUSHING ROLLS

First designed especially for laboratory sampling work, Sturtevant Crushing Rolls are used regularly in many plants where there are limited outputs. Range of output for the 8 x 5 size is from ½ in. to 20 mesh — and for the 12 x 12 size from ¾ in. to 20 mesh.

LABORATORY SAMPLE GRINDER

Laboratory Sample Grinders are of the "Open-Door" disc type and are capable of very fine work, producing products as fine as 100 mesh (coarser if desired) when working on dry, friable, soft or moderately hard materials. Simply turn hand wheel to provide product regulation from 10 to 100 mesh.

The only sure way to maintain strict quality of products is laboratory control . . . and that calls for accurate sampling.

Sturtevant Laboratory Equipment meets the exacting requirements of laboratory work. They are fast and accurate . . . provide true samples.

Rugged and dependable, Sturtevant equipment actually has all the features of full size machines plus extra accuracy and wider range of adjustment. The "Open-Door" accessibility permits quick, thorough cleaning . . . prevents the possibility of previous batches from contaminating new samples.

Investigate Sturtevant equipment for your laboratory. It will cut your sampling costs . . . help maintain strict quality of products . . . increase sales. Write for complete details and catalog.

STURTEVANT MILL COMPANY

101 CLAYTON STREET, BOSTON 22, MASS.

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS •

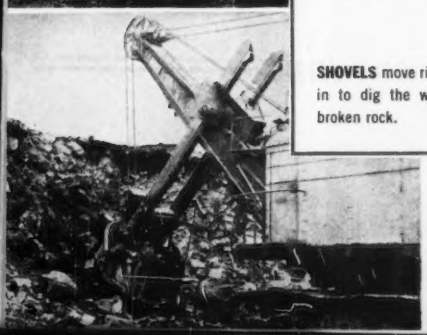
Better fragmentation from "Nitramex" No. 2 results in uninterrupted shovel operation.

ECONOMY
SAFETY
CONVENIENCE

Three important advantages of Du Pont "NITRAMEX" No. 2 demonstrated at Spruce Mine

"PRIMACORD" is tied on "Nitramon" Primer ready to be lowered into hole. Holes are 9 inches in diameter.

CREW LOADS "Nitramex" No. 2 into hole. Shots range from 30 to 100 holes with an average load of 200 lbs. per hole. Du Pont Blasting Timer is used to eliminate back break and reduce vibration.



SHOVELS move right in to dig the well-broken rock.

Economy, safety and convenience were major considerations in a program that called for shooting approximately 2¼ million cubic yards of rock overburden at the Oliver Iron Mining Company's Spruce Mine in Eveleth, Minnesota. Mine operators there used Du Pont "Nitramex"* No. 2.

Production economy of "Nitramex" No. 2 is evidenced by excellent fragmentation. Its high loading density and better spreading action pull the bottom satisfactorily even with wide hole spacings in tough-shooting rock. And the uniformly superior breakage allows uninterrupted shovel operation.

Safety characteristics of "Nitramex" No. 2—a new product of Du Pont Explosives Research—include all the well-known safety features of Du Pont "Nitramon."**

Convenient to use. "Nitramex" No. 2 contains no nitroglycerin, thus is non-headache producing . . . assures faster and more efficient loading. The cans are rugged, water-resistant and may be loaded days in advance of firing, if desirable. It all adds up to less trouble and more convenience on the job.

• • •

Ask your Du Pont Explosives representative for complete information about the economy, safety and convenience of this new, denser blasting agent. E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Delaware.

*Reg. trade-mark for ammonium nitrate blasting agent.
**Reg. trade-mark for nitrocarbonitrate blasting agent.

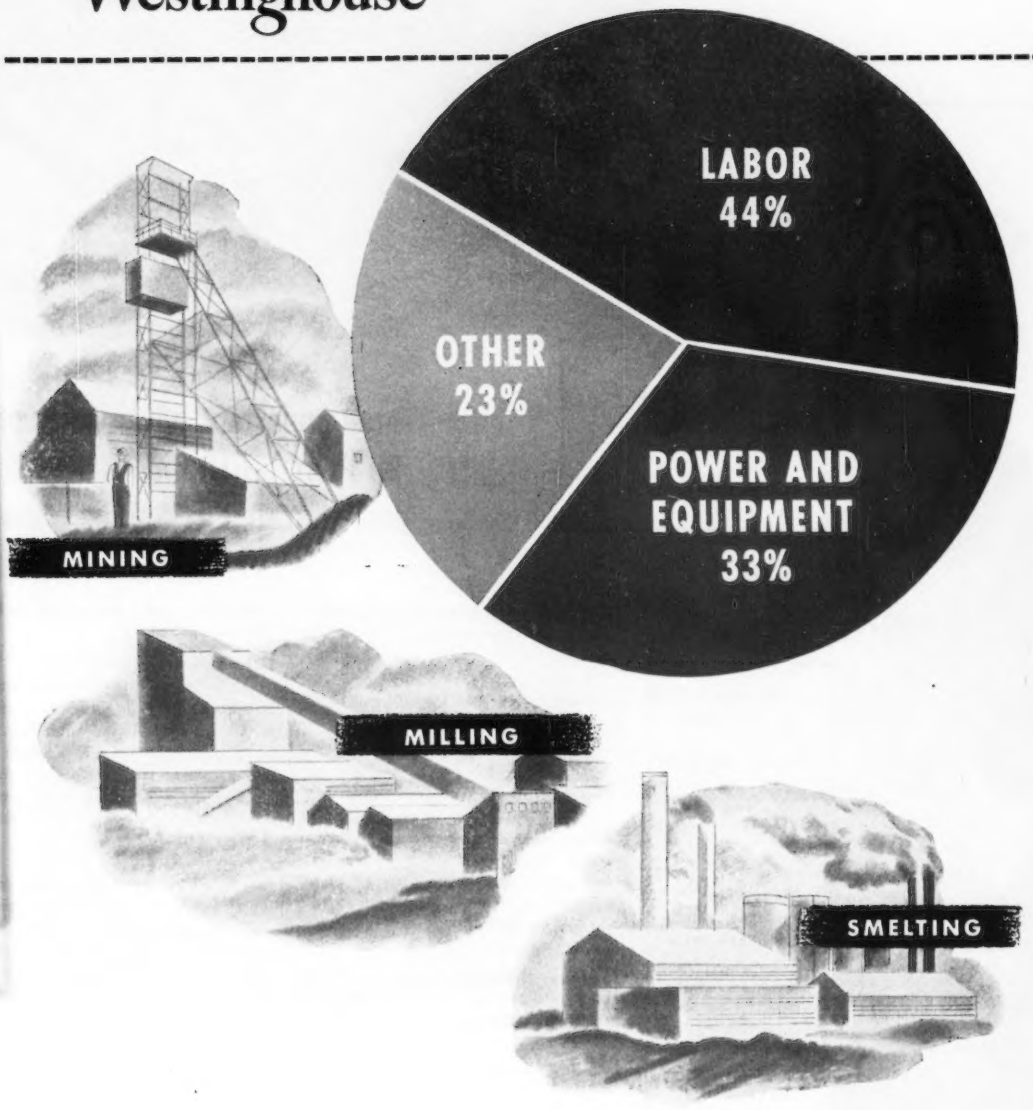
DU PONT "NITRAMEX" No. 2

Not currently for sale in western states

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

YOU CAN BE **SURE**.. IF IT'S
Westinghouse



EVERYTHING ELECTRICAL TO MINE ANYTHING

Have you studied your whole cost picture?

Labor is just one of your big cost items. Power and machinery themselves average 33% of the cost of mining ore.* Westinghouse can help you keep these costs in line—*because your electrical equipment has a major effect on them.*

Equipment Affects Basic Power Costs

In the first place, look at your actual power costs. Your power *distribution system* determines how much of the power you buy actually goes to work. A good system minimizes transmission losses and saves you money. And if you make your own power, the proper application of your generating apparatus will have a big effect on the balance sheet.

Influences Machine Efficiency

Perhaps even more important is the effect your electrical equipment has on machine efficiency—the return on your machine cost dollar. When the distribution system is right, voltage is properly maintained and motors deliver full rating. Drills, hoists, grinders, crushers, concentrators run as they're designed to. And they stay running without costly shutdown when their driving motors are carefully selected and power supply is dependable.

Equipment Itself Is Cost Factor

Finally, maintaining and replacing the electrical equipment itself can be a big factor on your books. If it's properly designed, properly built and properly *co-ordinated,* it is more efficient, runs longer and needs less attention.

Westinghouse Experience Can Help You

Building and co-ordinating electrical equipment to do the *best job* for your particular operation takes plenty of experience on the part of your engineers and your electrical manufacturer. For over 50 years Westinghouse has been helping the mining industry solve its electrical problems—and we've learned from experience how to meet *your particular needs.*

Westinghouse can supply the complete electrical equipment for your job. This simplifies your problems and, most important, you know the equipment is designed for strenuous mining service and designed to work together for maximum efficiency.

Let us help you review your present electrical setup now to be sure *all* of your production team is on the job. Just call your nearby Westinghouse office. And on future installations call in Westinghouse early in the planning stage.

J-94849

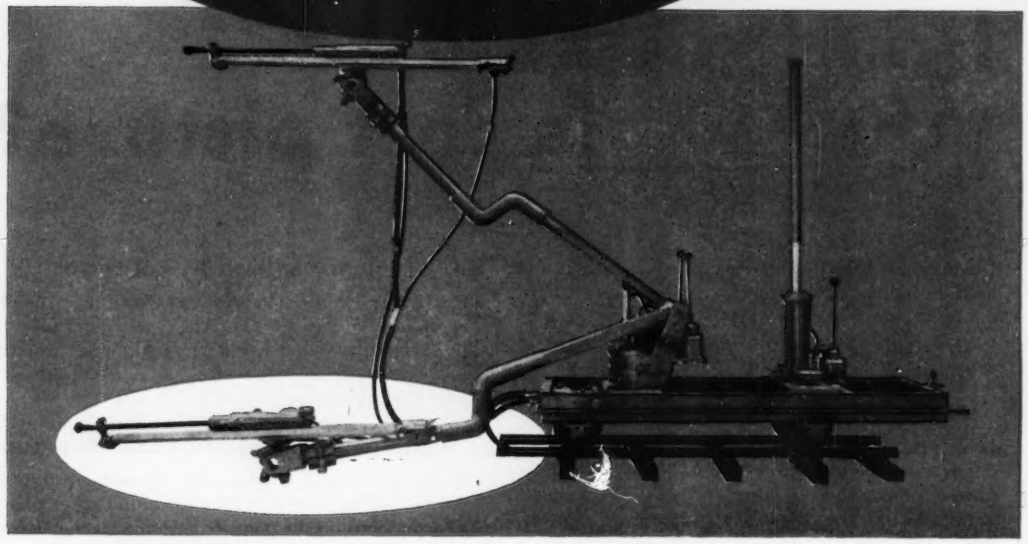
*Typical 1000-ton/day mine

Westinghouse

EQUIPMENT FOR THE MINING INDUSTRY

GIVE YOUR LIFTERS A LIFT!

Complete truck-mounted units include hydraulic roof jack and either one, two or three drill booms.



Hydraulic boom and roof jack units are available separately for mounting on your own custom-built jumbo.

These offset booms are great time-savers when you're drilling the lifters. Your runner doesn't have to take time out to swing the drill under — steel is easily and quickly centered on *every* hole in the face.

And that's only one of the *many* big advantages of Gardner-Denver Hydraulic Drill Jumbos. Other features include:

- Faster set-up—move in and start drilling.
- Faster tearing down—release hydraulic pressure and the jumbo's off to another heading.
- "Creep-free" booms—hold steel steady and true.
- Hydraulic roof jacks—hold truck on-the-spot.
- Handle long feeds—up to 10-foot steel changes—for efficient use of tungsten carbide bits.

Write today for complete information.

SINCE 1859

GARDNER-DENVER

THE QUALITY LEADER IN PUMPS, COMPRESSORS AND ROCK DRILLS

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

Moore Body Company "ARMORS" Truck-Bed Bottoms with J&L Jalloy Heat-Treated Plate

J&L STEEL

Impact- and Abrasion-Resistant Jalloy Plates Increase Service Life . . . Cut Deadweight of Moore Truck Bodies

The Moore Body Company of Reading, Pa., builds truck bodies for the mining industry where equipment really takes a beating. Moore has standardized on J&L Jalloy heat-treated plate to "armor" its truck-body bottoms against impact and abrasion.

The reason:—J&L Jalloy has a yield strength and Brinell hardness four times as great as mild steel. This makes it possible to cut deadweight by reducing plate thickness, and at the same time increase service life through Jalloy's high strength and wearing qualities.

For example, in Moore Body Company's 9 cu. yd. stripping body, 3/16" Jalloy has replaced 1/4" mild steel, and yet Jalloy's strength and hardness ensure increased resistance to abrasion and impact. Most important to cost-conscious mining men who must replace worn out truck beds—J&L JALLOY LASTS FOUR TIMES AS LONG AS MILD STEEL YET IT COSTS ONLY TWICE AS MUCH.

It's easy to see why more and more progressive mining companies have found that J&L Jalloy can do a dollar-saving job in such applications as chute liners, bulldozer blades, shovel buckets, and other places where impact and abrasion limit the life of equipment.

If you're responsible for the economical operation of earth-moving or handling equipment, you'll profit by writing for a free copy of our booklet, "For Longer Wear . . . Less Repair." It gives you complete information about J&L heat-treated Jalloy plate and shows you how others are saving money with this modern mining and quarrying steel.

Workman welding 3/16" Jalloy heat-treated plate in this Moore truck body. In construction no significant welding problems have been encountered.

Jones & Laughlin Steel Corporation
412 Jones & Laughlin Building
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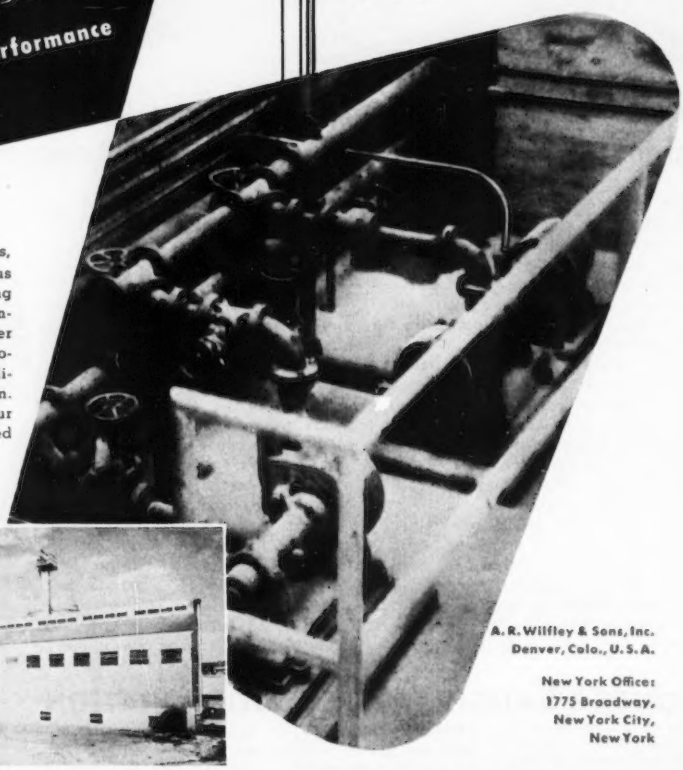

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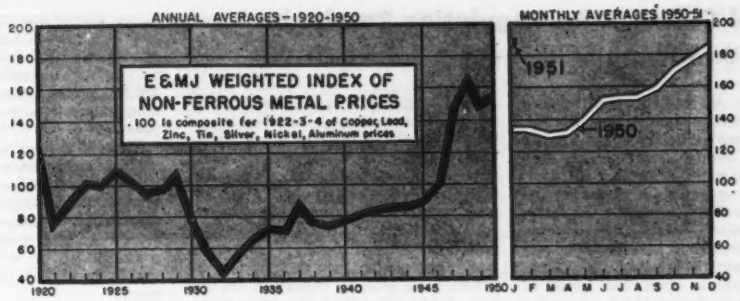
E&MJ OUTLOOK

PRICES



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MARKETS

ESA's price freeze order so confused metal and mineral traders that forward business, a major factor in normal market activity, nearly dried up as January ended. General revision of the order is indicated.

Demand for metal is still strong, and allocation of supplies is probably coming. Higher averages for tin, silver, and nickel pushed the E&MJ Index to 192.48 against 187.05 for December.

●

LABOR

There'll be fewer men than ever for mining this spring, but don't wait for Washington's help on manpower. Better canvass all self-help ideas, starting right now.

What a labor shortage there'll be in Arizona when and if San Manuel, P-D's Bisbee job, and one other big new copper project get started!

●

AT HOME

Look for early collapse of price and wage control unless Congress backs it up with stiff taxes, credit control, and non-defense economies.

Get set for a tax-hungry Treasury's drive on depletion allowances and the special concessions to mining in the revised 1950 tax law.

Substitution Note: Philco is all set to build a low-cost television receiver that uses no cobalt or nickel and very little copper.

Unless Washington steps in, U. S. zinc smelters will lose even greater tonnages of concentrates to foreign bidders this year.

Although there's **no L-208 in sight for gold mines,** several smaller gold companies are quietly looking around for something else to do.

Silver's jump to near the Treasury price ($0.905) is almost sure to bring a bill for $1.29 silver before Congress.

M. A. Hanna gained a direct interest in Minnesota taconite through National Steel's purchase of 15% of Reserve Mining Co., leading taconite owner. Armco and Republic share the rest of Reserve. Hanna also plans early pilot plant work on a **nickel property** near Riddle, Ore.

Nicaro Nickel, in Cuba, will operate under direction of Mining Equipment Corp., subsidiary of N. V. Billiton, Dutch tin company.

●

ABROAD

U. S. politicking over the $400-million aluminum project for British Columbia hasn't halted the job. It simply means that we'll have to pay more for B. C. aluminum when we do eventually buy it.

Although free-market gold rose in January to $44-$49, Canada's proposed sale of around $30 million in gold would break the price again.

South Africa will use much of its **$50 million International Bank loan** to buy mining and railroad equipment in the U. S.

There should be **a big drop in U. S. lead imports** this year. Greater demand and higher prices abroad will be responsible.

MARKETS—Trends and Prices

General Ceiling Price Regulation Results in Confusion Among Sellers — Tin Above $1.80

IN A MOVE TO ARREST the upward trend in prices, the Economic Stabilization Agency issued late on Jan. 26 what was described as a stop-gap price-wage freeze. The General Ceiling Price Regulation became effective immediately. The purpose of the regulation is to establish ceiling prices for all commodities and services, except some agricultural products specifically exempt, upon the basis of prices in effect during the base period of Dec. 19, 1950, to Jan. 25, 1951, inclusive. The danger that inflationary pressures would get out of hand caused the authorities in Washington to act before the machinery for enforcing this tremendous job could be assembled.

The price-wage order was viewed by buyers and sellers as unworkable and supplementary regulations will undoubtedly be issued from time to time to take care of special and varied cases. Trading in metals on the Commodity Exchange was suspended Jan. 29. The pricing of imported products became an almost impossible task. Particularly obnoxious to traders was the section that covered the fixing of a ceiling price which reads, in part:

"Your ceiling price for sale of a commodity or service is the highest price at which you delivered it during the base period to a purchaser of the same class."

So far as the regular "white" market in major non-ferrous metals was concerned—copper, lead and zinc—the ceiling regulations caused no hardship. Meetings held in Washington early in January virtually placed these metals under voluntary price control. ESA pointed out that prices had been stable and "upon assurances from members of the industry that they would not advance their prices without first notifying the agency of any such action should it be contemplated at any future time," the matter of placing a ceiling price on these metals could be postponed.

Prices of imported commodities continued to rise. The tin situation was particularly disturbing to consumers who were forced to pay $1.83 per pound for prompt metal. Fear buying was responsible for the upturn in prices. The over-all supply of tin has been fairly constant in recent months. Quicksilver was marked up sharply by the Spanish interests. As January ended, they were asking $200 per flask, f.o.b. port of shipment, a jump of $85 compared with a month previous. Purchases by chlorine makers were a factor in raising the Spanish price, operators here believe. After rising here to $225 per flask, the price declined in a dull market to $200. Tungsten and antimony ores were higher.

The E&MJ price index advanced in January to the new high of 192.48, which compares with 187.05 in December and 135.86 in January a year ago.

Demand for non-ferrous metals continued active, notwithstanding restrictions on use and the inventory regulations that became effective at the beginning of the year. Defense orders were more numerous. In some metals, DO orders now account for approximately 10% of current business. Doubt exists in the minds of many producers whether more drastic controls are necessary to bring supply and demand in balance.

Copper Consumption Up.

During December, fabricators in the United States shipped the equivalent of 115,390 tons of refined copper to their customers, making the total for the year 1,440,895 tons. This compares with 1,053,225 tons shipped in 1949 and 1,394,307 tons in 1948. Stocks of refined copper in the hands of fabricators as December ended totaled 289,313 tons, against 277,590 tons a month previous and 354,992 tons a year ago.

Though copper sold in the outside market continued to move at premium prices, the tonnages involved in such transactions were small. Producers' sales in the domestic market have been averaging well over 100,000 tons a month, all of which was moved on the basis of 24½c. per pound, delivered.

Bills have been introduced in Congress for the temporary suspension of the 2c. import duty.

Lead sales have held up remarkably well. Complications introduced by the higher duty that became effective Jan. 1, 1951, exerted no influence on the market. The price situation remained strong. Except for opposition to rising prices in Washington, there might have been no hesitancy about lifting

Average Prices for January (E&MJ Quotations)

Copper:	
Electrolytic, Domestic, Refinery	24.200
Electrolytic, Export, Refinery	24.425
Lead:	
Common, New York	17.000
Common, St. Louis	16.800
Silver and Sterling Exchange:	
Silver, New York, per oz.	88.709
Silver, London, pence per oz.	76.568
Sterling Exchange, "Checks"	279.972
Zinc:	
Prime Western, East St. Louis	17.500
Tin:	
New York Straits	171.779
New York, 99% min. (e)	170.779
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$195.000
Antimony (E&MJ) (d)	38.742
Antimony, bulk, Laredo	35.462
Antimony, in cases, Laredo	35.962
Platinum, refined, per oz.	$90.000
Cadmium, (a)	255.000
Cadmium (b)	267.500
Cadmium (c)	280.000
Aluminum, 99% plus, ingot	19.000
Magnesium, ingot	24.500
Nickel (f)	50.500

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange, checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotation.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.

(e) Tin contained.

(f) F.o.b. Port Colborne, U. S. duty included.

E & M J Index of Non-Ferrous Metal Prices

(100 is composite for 1922-3-4)

Year			1947	1948	1949	1950
1939	77.71	January	140.88	154.20	185.52	135.86
1940	79.22	February	140.42	155.63	185.75	135.65
1941	83.49	March	150.71	155.63	179.31	132.60
1942	86.80	April	153.14	160.67	160.86	134.04
1943	88.74	May	154.03	161.33	148.05	142.02
1944	88.74	June	150.05	162.30	131.20	154.30
1945	90.86	July	148.73	164.55	136.65	156.40
1946	110.06	August	149.35	177.68	141.90	160.67
1947	149.46	September	150.80	178.26	142.24	172.56
1948	168.38	October	151.05	179.58	137.81	179.83
1949	151.97	November	151.92	185.26	138.18	186.00
1950	156.42	December	152.48	185.52	136.18	187.05

the domestic quotation, which continued at 17c., New York. In the export market 18½c. was paid, f.a.s. Gulf ports.

Zinc producers, at a meeting with NPA officials, opposed the introduction of specific controls on end use of the metal without first determining whether existing limitation orders are taking hold. ESA is looking into the East St. Louis basing point method of selling zinc under its control program. The domestic market for Prime Western zinc was unchanged all month at 17½c., East St. Louis. In the export market prices were nominal at 25c. and upward, f.a.s. Gulf ports.

Because of expanding defense needs for tungsten the demands could not be satisfied. The price continued to advance, moving up to $65 per short ton unit of WO_3 on foreign ore, in bond, equivalent to $73 duty paid.

Antimony ore was strong. Higher costs forced domestic producers of antimony metal to raise their prices. National Lead advanced its quotation on the 99½% grade 10c. per pound to the basis of 42c., in bulk, carload lots, f.o.b. Laredo, Texas. Bradley Mining quoted the market at 50c. per pound, in bulk, f.o.b. Cascade, Idaho.

(*Continued on page* 129)

Major Metals

U. S. DAILY AND AVERAGE PRICES

	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis	
Jan. 1951							Jan. 1951
1	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday	1
2	24.200	24.425	150.000	17.000	16.800	17.500	2
3	24.200	24.425	153.000	17.000	16.800	17.500	3
4	24.200	24.425	157.000	17.000	16.800	17.500	4
5	24.200	24.425	156.000	17.000	16.800	17.500	5
6	No Market	24.425	156.000	17.000	16.800	17.500	6
8	24.200	24.425	159.000	17.000	16.800	17.500	8
9	24.200	24.425	163.000	17.000	16.800	17.500	9
10	24.200	24.425	170.000	17.000	16.800	17.500	10
11	24.200	24.425	173.000	17.000	16.800	17.500	11
12	24.200	24.425	175.000	17.000	16.800	17.500	12
13	No Market	24.425	175.000	17.000	16.800	17.500	13
15	24.200	24.425	172.000	17.000	16.800	17.500	15
16	24.200	24.425	175.000	17.000	16.800	17.500	16
17	24.200	24.425	176.000	17.000	16.800	17.500	17
18	24.200	24.425	175.750	17.000	16.800	17.500	18
19	24.200	24.425	175.500	17.000	16.800	17.500	19
20	No Market	24.425	175.500	17.000	16.800	17.500	20
22	24.200	24.425	176.000	17.000	16.800	17.500	22
23	24.200	24.425	178.000	17.000	16.800	17.500	23
24	24.200	24.425	180.000	17.000	16.800	17.500	24
25	24.200	24.425	183.000	17.000	16.800	17.500	25
26	24.200	24.425	182.000	17.000	16.800	17.500	26
27	No Market	24.425	182.000	17.000	16.800	17.500	27
29	24.200	24.425	183.000	17.000	16.800	17.500	29
30	24.200	24.425	183.000	17.000	16.800	17.500	30
31	24.200	24.425	182.500	17.000	16.800	17.500	31
			AVERAGES FOR MONTH				
Jan.	24.200	24.425	171.779	17.000	16.800	17.500	Jan.
			AVERAGES FOR WEEK				
Jan.							Jan.
3	24.200	24.425	151.000	17.000	16.800	17.500	3
10	24.200	24.425	160.167	17.000	16.800	17.500	10
17	24.200	24.425	174.333	17.000	16.800	17.500	17
24	24.200	24.425	176.792	17.000	16.800	17.500	24
31	24.200	24.425	182.583	17.000	16.800	17.500	31
			CALENDAR WEEK AVERAGES				
Jan.							
6	24.200	24.425	154.400	17.000	16.800	17.500	
13	24.200	24.425	169.167	17.000	16.800	17.500	
20	24.200	24.425	174.958	17.000	16.800	17.500	
27	24.200	24.425	180.167	17.000	16.800	17.500	

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(*a*) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(*b*) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound.

Quotations for zinc are for Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West during December commanded a premium of 1.10c. per pound over the current market for Prime Western; Special High Grade 1.25c.

Quotations for lead are for common lead. Corroding lead commands a premium of 10 points.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
Jan. 1951					
1	Holiday	Holiday	Holiday	Holiday	Holiday
2	280.000	80.000	70.000d.	248s.	$35.00
3	280.000	80.000	70.000d.	248s.	35.00
4	280.000	80.000	70.000d.	248s.	35.00
5	280.000	no quotation	70.000d.	248s.	35.00
6	(c)	(c)	(c)	(c)	35.00
8	280.000	90.160	70.000d.	248s.	35.00
9	280.000	90.160	78.500d.	248s.	35.00
10	280.000	90.160	78.500d.	248s.	35.00
11	279.875	90.160	78.500d.	248s.	35.00
12	279.875	90.160	78.500d.	248s.	35.00
13	(c)	(c)	(c)	(c)	35.00
15	279.875	90.160	78.500d.	248s.	35.00
16	279.875	90.160	78.500d.	248s.	35.00
17	279.875	90.160	78.500d.	248s.	35.00
18	280.000	90.160	78.500d.	248s.	35.00
19	280.000	90.160	78.500d.	248s.	35.00
20	(c)	(c)	(c)	(c)	35.00
22	280.000	90.160	78.500d.	248s.	35.00
23	280.000	90.160	78.500d.	248s.	35.00
24	280.000	90.160	78.500d.	248s.	35.00
25	280.000	90.160	78.500d.	248s.	35.00
26	280.000	90.160	78.500d.	248s.	35.00
27	(c)	(c)	(c)	(c)	35.00
29	280.000	90.160	78.500d.	248s.	35.00
30	280.000	90.160	78.500d.	248s.	35.00
31	280.000	90.160	78.500d.	248s.	35.00
	AVERAGES FOR MONTH				
Jan.	279.972	88.709	76.568d.	—	35.00
	AVERAGES FOR WEEK				
Jan.					
3	280.000	80.000	—	—	—
10	280.000	87.620	—	—	—
17	279.875	90.160	—	—	—
24	280.000	90.160	—	—	—
31	280.000	90.160	—	—	—

Calendar week averages. New York Silver: Jan. 6th, 80.000; 13th, 90.160; 20th, 90.160; 27th, 90.160.

(*c*) No market (Saturday).

Quotations for silver are for prompt delivery of bullion containing approximately 999 fine silver, in cents and one-eighth cent fractions per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance for carrying, delivering and marketing. In addition to foreign silver, the quotations also apply to domestic and Treasury silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver is 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(*d*) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Behind the By-Lines . . .

G. P. Lutjen

» **Into each year a little February must fall, and with it comes the E&MJ Annual Review and Outlook number. This is essentially the mineral industry's box score—hits, runs and errors—for the past year plus a careful squint at the year ahead. Here are some of the questions the crew is on deck to answer for you.**

Who broke the price of gold in the free market and why?

What mineral dressing process is losing its glamour?

How has the mining man's thinking changed on tungsten-carbide drilling?

How does Point Comfort highlight aluminum's major problem?

Could zinc ease up in the first quarter of 1951?

What's the quickest way to solve strike-dip geologic problems?

How many Continuous Miners are being used to mine non-metallics?

What metal price jumped the most?

What invention brought electric rock drilling one step closer?

» **In "Dorrco Doings," house organ of the Dorr Co., we found the following glossary which we pass along to aid those who are aspiring to top management positions.**

Executives' Glossary, or
Helpful Hints to the High Powered

A program. Any assignment that can't be completed by one telephone call.

Channels. The trail left by inter-office memo.

Coordinator. A guy who has a desk between two expediters.

To implement a program. To hire more people and open more field offices.

Under active consideration. We're looking in the files for it.

A meeting. A mass mulling by master-minds.

A conference. A place where conversation is substituted for the dreariness of labor and the loneliness of thought.

To negotiate. To seek a meeting of minds without a knocking together of heads.

To give someone the picture. A long, confused and inaccurate statement to a newcomer.

A clarification. To fill in the background in such detail that the foreground goes underground.

A survey is being made of this. We need more time to think of an answer.

Will advise in due course. If we ever figure it out, we'll let you know.

» **What would you do if you got this letter in the mail?**

Mexico City, Nov. 18.

Dear Sir:

A person who knows you and who has highly spoken about you has made me trust you a very delicate matter of which depends the entire future of my daughter as well as my existence.

I am in prison sentenced for Bankruptcy and I wish to know if you are willing to help me save a sum of $385,000.00 *which I have in Bank Bills, inside of a secret place in a trunk that is deposited in a Custom-house in United States.*

As soon as I send you some undeniable evidence, it is necessary for you to come here and pay the expenses incurred in connection with my process in order to lift the embargo on my suit cases, one of which contains the necessary documents (a baggage check) that we need to take out the trunk that contains the cash and which is deposited in a Custom-house in North America.

To compensate you for all your troubles I will give you THE THIRD PART OF SAID SUM.

Fearing that this letter may not come directly to your hands, I will not sign my name until I hear from you and then I will entrust you all my secret. For serious reasons that you will know later, please reply via air mail.

I beg you to treat this matter with the most absolute reserve and discretion. Due to the fact that I am in charge of the Prison's School, I can write you freely and in this way.

For the time being I will sign only "V."

I cannot receive your reply directly in the prison so in case you accept my proposition please air-mail your letter to a person of my entire trust who will deliver it to me safely and rapidly. His name and address are given below.

V.

This letter was actually received by a prominent mining engineer in the U. S., who turned it over to Col. R. E. Franklin of San Francisco, who in turn passed it on to E&MJ as a prime example of the old "Spanish Prisoner" con game. Less amused than irritated, we pass it along as warning to those who figure prominently on the confidence man's sucker list. Remember the old Greek saying, "A fool and his money are some party," or something.

» **At the risk of being branded "isolationists" or** whatever epithet is currently in vogue in Washington name-calling circles, we would like to express our dissatisfaction with the speed at which our national defense program is proceeding (and we use the term "proceeding" loosely). The whole deal reminds us of the story of the three turtles who dropped in at their favorite pub for a glass of beer. While quaffing a brew or two, they noticed that it had started to rain outside, so the biggest turtle turned to the smallest turtle and said, "Shorty, go home and get the umbrella."

"Well," said Shorty, "Okay, if you promise not to drink my beer."

"We promise," said the other two. "Scouts' honor."

But after two years had gone by the biggest turtle turned to the medium turtle and spake thus, "I don't guess he's coming back. We might as well drink his beer."

Just then a little voice from just outside the door called out, "If you do, I won't go."

ENGINEERING AND MINING JOURNAL

FEBRUARY, 1951

The Job for 1951—Produce and Prepare

WHETHER WE THANK PROVIDENCE, or our advantage in atomic weapons, or Russian unpreparedness to start a major conflict for the fact that we or Europe were not attacked in recent months, we know that it would be the height of folly if we fail to shore up our defenses at top speed, even though this may involve reconversion aches and pains a few years hence.

We know that neither Providence nor atomic weapons can be relied upon to protect us if we are stupid enough to remain wide open to attack. The present rulers of Soviet Russia are clearly implacable in their enmity toward our free institutions. In the face of such malevolent might, the only possible way to avert a world catastrophe is to be so well prepared that to attack us will be an unpromising venture. On the speed and determination with which we eliminate our vulnerability depends the future of individual freedom everywhere!

We cannot really win another world war. Neither can the Soviets. If after a struggle we prevail over them, we shall have a chaotic, unmanageable situation on our hands, a miserable, numerous people, and a vast section of the earth with no constructive traditions in self-government. This would be an immense, natural seed bed for the kind of barbarism we now face, but with the free world even more weakened than it now is for holding it in check. On the other hand, if the Soviets should prevail over us, their triumph would mark merely the beginning of a terrible, endless effort to blot the memory and hope of freedom from men's minds. Clearly, war must be avoided by the compelling power being in the hands of those most reluctant to use it.

A Vital Role

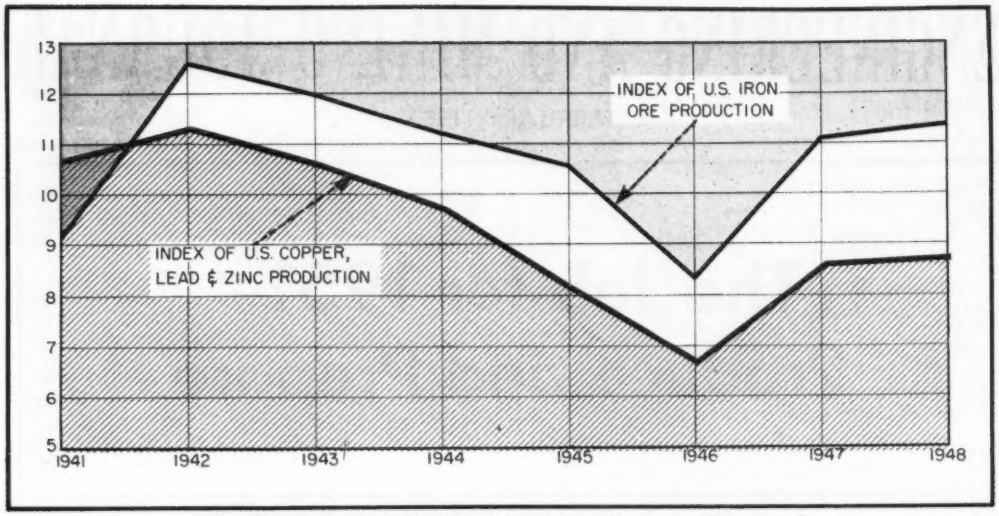
IN THE MATTER OF BEING PREPARED, the mining industry has a vital and honorable role; also, a serious responsibility. A glance at the problems that have caused officials the most concern in recent months shows how important a sustained high production of mineral raw materials is to a successful defense effort. The mines must produce as never before, and with a less than plentiful supply of manpower, technical skill, equipment, supplies, power and transportation. And the nation will not—or should not—dare to afford lagging exploration, insufficient development work, pirating of manpower, shortages of equipment and slackening of development of better equipment. If mining falters, a whole superstructure of essential industries begins to crumble.

It is quite evident that defense production officials have a clearer idea of the importance of mineral raw materials than in the early days of World War II. They all realize that until and unless a large army is mustered, raw-material supplies are the chief limiting factors to expanding production. They apparently do not yet realize the seriousness of the mining manpower problem, the infeasibility of putting just anyone into the mines if the industry loses its skilled labor, or the long, hard pull necessary to make large, sustained expansions of mineral output.

The evidence of demand for all the mining industry can produce is so great that probably the best general contribution we can make to readers' views is to answer if there are any reasonable doubts as to this assumption.

On the doubtful side one can point to the temporary nature of the important demands due to stockpiling and to inventory accrual. He can predict, with fair assurance, that the Russians will try to keep our economy off balance by alternate threats and professions of "peace," and that the American people will be reluctant to support strong military preparations in those periods when no battles are being fought. In fact, the widespread public receptivity toward ex-President Hoover's position of letting Europe take the initiative in defending itself while we prepare ourselves primarily to guard the Western Hemisphere could be construed to indicate that a slower but steadier pace of defense preparation will prove to be the pattern.

Nevertheless, we deem the evidence of insatiable demand to be conclusive. The Soviet failure to seize Europe's steel-making resources and facilities and Near-Eastern oil is not a token of peaceful intent but merely that they are unprepared for full-scale war now



THE PRODUCTION DECLINES of World War II must not be repeated.

or are hopeful of gaining their ends by economic attrition, propaganda, infiltration, and incidents in the Korea pattern. It is inconceivable that in the face of such compelling evidence of Soviet long-term intentions the American people can be so foolish as to lapse into a state of unpreparedness. The outlook is either for extensive preparedness or for war, but not unarmed peace.

These conclusions mean to the mining industry that the demand for full production will be of long duration and that any expansions possible within the next few years will not be wasted.

As for the stockpile, the day will come, barring war, when its goals are fulfilled and it will no longer be a large sustaining factor in the mineral markets. However, defense production, domestic and foreign, will prevent rapid building of the stockpile and no doubt, as the goals are approached, they will be enlarged. Considering the essential and non-deteriorable nature of minerals and their probable improvement in value as time goes on, the one way the nation cannot afford to err is on the side of deficiency. If surpluses ultimately prove to exist, either in the stockpile or productive capacity, they are bound to be profitable to the American taxpayer.

A Problem of Balance

ONE OF THE MOST DIFFICULT PROBLEMS that the nation will face will be to keep its economy in balance. To eliminate our present dangerous vulnerability, it will be necessary to arm at or near top speed. However, once the desired level of armament is reached, defense production will have to be slowed down if we are not then at war, as the destruction and waste of actual warfare will probably be lacking. The defense production level will then be determined by the degree of obsolescence of material produced in the meantime.

However, such alterations in the level of defense production, if they occur, will not necessarily mean a slackening in the demand for minerals. There will be backlogs of unfilled consumer needs, as in wartime, calling for mineral raw materials. There is our still expanding economy, due both to population growth and to various changes which have tended to spread purchasing power among the masses. By the time that these demands will have been satisfied, probably depletion will have made enough inroads into our present sources of production that the ones brought into being in the next few years will be needed to serve peacetime markets.

If these assurances are not enough to resolve doubts about future markets, the industry's course is clear nevertheless. As a matter of duty to the nation and to the young men who are being called to the colors, the mining industry simply cannot hesitate to do its utmost toward buttressing national security.

Not Enough to Produce

MEANWHILE, if the nation takes logical preparedness steps, the mining industry will have more to do than simply to produce all it can. Redoubled efforts should be made in exploration and exploration research in order to improve the mineral reserve picture. Between the expanded demands of possible war and the knowledge that in wartime no industry, however preferred, can expect to have an easy manpower supply, it is important not only to catch up development work, but to create unusual development reserves. For the same reason, opportunities to save manpower by greater mechanization or changed methods must be weighed more heavily than on a simple basis of paying out under current conditions. To assume that in any future crisis the United States can get by as easily as we did in World War II is ridiculous, and it would be utterly foolish to risk the decline in mineral production which took place in the later years of World War II, chiefly due to underdevelopment and lack of manpower. Also, while we have the elbow-room to prepare,

it is time to do everything possible to put plants and facilities in the best possible shape for an overload.

The part that Government will play in helping accomplish these tasks is not clear. The Defense Production Act of 1950 grants authority to make loans and purchase contracts in order to encourage mineral exploration, development and production. However, the authority for "encouragement of exploration, development, and mining of critical and strategic minerals and metals" is complicated by lack of funds for this particular purpose and by the limitation "that purchases or commitments to purchase involving higher than currently prevailing market prices or anticipated loss on resale shall not be made unless it is determined that supply of the materials could not be effectively increased at lower prices or on terms more favorable to the Government." Also the Act's application to foreign developments is uncertain.

More Controls

IN THE PRICE FIELD, the Economic Stabilization agency has already set up price and wage ceilings, although, lacking a large administration and enforcement staff, it is dubious how controls can be made to work. From the mining industry viewpoint this is illogical, as the industry should have the means of meeting competition for its manpower and to do the jobs outlined above. It should do everything possible to make the price authorities aware of these needs. There remains, however, the probability that the price authorities, as in World War II, will fix ceilings primarily for fear of the inflationary impact of higher metal prices on the general price structure, and take the position that the mining industry's additional financial needs must be met from some form of subsidy.

It even seems possible that price rollbacks may occur in some instances in keeping with the ambiguous promise of ESA to keep manufacturers' raw-material costs in line with Dec. 1, 1950, prices of their products. Such a move, if it occurs, will outrage the mining industry and will no doubt be vigorously protested. How successfully is impossible to predict. To control prices equitably in an economy like ours, particularly on short notice, seems beyond human capabilities.

An interesting and potentially painful problem devolves around the clause in Defense Production Act which calls for complete "stabilization" of an industry when prices of its products are made subject to mandatory ceilings. Obviously, however, the Administration, so heavily dependent on the good will of organized labor, will do a half-hearted job of enforcement on the wage front, and is likely to develop a situation where enterprises will find themselves squeezed more and more severely between costs and prices. Considering the difficulty of solving this problem within a democratic framework, it is impossible to foresee a solution, unless by further inflation.

There is little doubt that during 1951 many of the products of the mines will be subjected to Government controls in addition to those already in effect. Further allocation procedures, conservation-in-use orders, and end-use restraints will be applied, and all observers agree that the economy will be controlled largely through control of materials. The anticipated Controlled Materials Plan, expected to be in operation by mid-year, will, as in World War II, primarily affect steel, copper, and aluminum, but other minerals will also be controlled to an important degree.

That control of key raw materials will become international is already indicated by the many material deficiencies already apparent within the free world and by the steps already being taken to set up international controls. This will mean that in many instances all importation will be for Government account, and Government will absorb whatever differentials exist between foreign and domestic prices.

Whither Private Enterprise?

IN THE NEXT FEW YEARS more than ever before the bogie of Government control and participation will loom before the mining industry. The more drawn-out the conflict becomes, the greater the danger will be of Government participation becoming permanent. Marginal elements in the industry particularly, but not exclusively, will tend to form a habit of looking to Government for the cures for their ills rather than to face the disciplines of a free economy.

When Government encroachment seems necessary in the name of national security, nobody can resist effectively on principle. What then, can members of the industry do to prevent growth of conditions that in the end will injure both the industry and the public? It can demand that the people who administer the mineral affairs of the Government must be sincerely sympathetic to the perpetuation of private enterprise. More important, it can try to do the jobs which, left undone, provide a reason for the entrance of Government into its affairs.

Strength Is Individual

IN CONCLUSION, we, our country, and free institutions everywhere face one of the gravest menaces that history has ever recorded. The menace is grave, not because it has inherent strength or we lack greater strength, but of the danger that through disunity and indecisiveness we will dissipate our great advantages. In the industrial field we are strong because we are productive and we are productive because our system is based on voluntary efforts spurred by realistic incentives. Such a system, properly handled, can always outproduce a terroristic, forced-labor regime, but to meet the demands of an emergency, its strength rests upon individual devotion to the ideals which we hold in common and on individual willingness to make sacrifices for them. We cannot win by converting our system into one like that we oppose. Our responsibility in industry is to take the initiative in ending the destructive feud between organized labor and management, and to build up individual devotion by putting fair play and national security ahead of all other aims.

If the free world can put aside selfishness, disunity and indecisiveness to a reasonable extent, it is invincible. If it cannot, nobody who has ever enjoyed freedom will find much to choose between life and death. We are confident that the American people, traditionally muddled when trouble begins, will recognize what is at stake and will demonstrate their strength as the need arises.

Metals in REVIEW

Gold

» Improved dollar balances, industrial recovery in Europe, reverse gold flow to U.S. Premium prices decline in free markets; IMF holds official price.

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LAST YEAR'S GOLD DEVELOPMENTS, though neither spectacular nor dramatic, appear to have been in the direction of enhancing the role of gold in present-day world economy and finance. Three salient aspects will be broadly examined in this review.

1. World gold output (excluding the USSR) increased last year by only 1,000,000 oz., despite the increased profitability of gold mining due to devaluation of various currencies.

2. Instead of being a net gold buyer, the United States last year became a net gold seller.

3. Gold prices in world free markets had declined by the middle of 1950 so much that the sale of newly-mined gold from South Africa for industrial and artistic purposes ceased to be profitable.

[1]The author is on the staff of the Federal Reserve Bank of New York. The views he expresses are his own and are not meant to reflect those of the Bank.

1. Gold Output Increases

Gold output of the principal producing countries other than the Soviet Union was about one million fine ounces higher last year than in 1949, amounting to 24.6 million oz. (Table I.) Continuing the postwar rise in output, 1950's production was 3.3 million oz. over 1945's, the postwar low. It was still 12.1 million oz. below the all-time record of 1940. However, current output is well above that for 1920-1930.

Last year was the first full calendar year after the September, 1949, currency readjustments had raised the official gold prices of the devaluing countries, which together account for some 80% of the world gold output outside the USSR. The rise in official gold prices, 44% in the sterling area, 14% in the Belgian Congo, and 10% in Canada up to the abandonment of the fixed United States dollar exchange rate last October, was, of course, only an incidental result of the currency readjustments. It did enhance the profitability of gold mining in varying degree.

Despite devaluation, there was no spectacular rise in gold output last year. Indeed, as can be clearly seen from Table I, it was the gold-producing countries that had devalued most, South Africa, Rhodesia, and Australia, which failed to increase their output. On the other hand, the United States, which maintained its gold price unchanged, and Canada and Belgian Congo, which raised it only moderately, were together responsible for four-fifths of the one million ounce rise in last year's world output.

Gold production in the United States for the full year 1950, on the basis of the first ten months, may be put at 2.4 million oz., or some 0.4 million more than in 1949 or 1948. The 19% rise in production, the first one since 1947, seems to reflect in part the increase in by-product gold recovered in base-metal mines and in part the new postwar investment in gold mines.

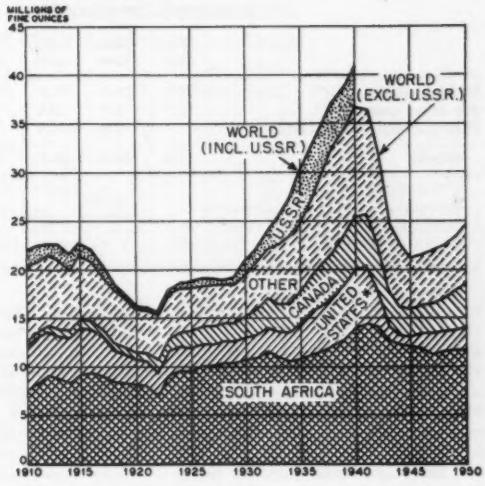
Canadian output rose last year to some 4.4 million oz. from 4.1 million in 1949, an increase of 8%. Last year Canadian production rose to within 17% of the 1941 record level. Since January, 1948, Canadian producers with high operating

Table I. World Gold Production

(IN MILLIONS OF FINE OUNCES)

	1940	1947	1948	1949	1950[1]
North America:					
Canada	5.3	3.1	3.5	4.1	4.4
United States	4.9	2.2	2.0	2.0	2.4
Central and South America:					
Mexico	0.9	0.5	0.4	0.4	0.4
Colombia	0.6	0.4	0.3	0.4	0.4
Chile	0.3	0.2	0.2	0.2	0.2
Nicaragua	0.2	0.2	0.2	0.2	0.2
Africa:					
Union of South Africa	14.0	11.2	11.6	11.7	11.7
Gold Coast	0.9	0.6	0.7	0.7	0.7
Southern Rhodesia	0.8	0.5	0.5	0.5	0.5
Belgian Congo	0.6	0.3	0.3	0.3	0.4
Asia:					
India	0.3	0.2	0.2	0.2	0.2
Philippines	1.1	0.1	0.2	0.3	0.3
Oceania:					
Australia	1.6	0.9	0.9	0.9	0.8
Total	31.6	20.2	21.0	21.9	22.6
Other countries, excluding USSR	5.1	1.9	1.6	1.8	1.9
World, excluding USSR	36.7	22.1	22.6	23.6	24.6

[1]Tentative figures based on preliminary or incomplete data.
Note: Figures may not add up to totals because of rounding.



costs have been given federal subsidies, under a program that was held by the International Monetary Fund as "not inconsistent" with its policies under existing circumstances. The Emergency Gold Mining Assistance Act of 1948, which was due to expire at the end of 1950, was extended last year through 1951. Federal assistance to Canadian gold mining averages somewhat less under the new formula than previously.

South African output amounted last year to nearly 11.7 million fine oz., a little below output in 1949 and only slightly more than in 1948, which was the first year since 1941 in which there was any increase in production. Yet the Transvaal mines greatly benefited by the South African pound devaluation. The 44% rise in the official price of gold enabled the industry to lower the average grade of ore milled, thus reducing from 3.0 dwt. per ton to 2.1 dwt. the theoretical extraction ratio at which gold mining became profitable at the costs prevailing at the time of devaluation. However, within a year after the devaluation, rising working costs in the South African gold mining industry had wiped out almost 25% of the 0.9 dwt. by which the higher official gold price had lowered the point at which extraction became profitable.

About two-thirds of the increase in costs lay in higher wages, the remainder being due to higher railroad freight rates and commodity prices, especially for imports.

Yet, in spite of rising costs, working profits are much higher than before devaluation. While declared working profits of Transvaal mines during January to August, 1949, amounted to £1.9 million monthly, they increased to 4.3 million monthly in January to October, 1950. Dividends distributed in the first six months of 1950 amounted to £12.7 million as against 6.4 million in the first half of 1949.

The South African gold mining industry last year attracted American and Swiss capital. The Union Government obtained a revolving credit of $20 million from United States banks and a loan of 36.5 million francs from a group of Swiss banks. The Kennecott Copper Corp. recently subscribed in dollars the equivalent of £2.2 million of working capital for a new mine in the Orange Free State, and the Anglo-American Corp. of South Africa raised a 50 million Swiss franc loan for a period of 12 years in order to assist the financing of its new mining enterprises. The Union was also able to borrow up to £20 million in Great Britain; the British authorities have not placed any embargo on the flow of capital to South Africa.

Whether the 1949 rise in the sterling price of gold is likely to lead ultimately to a sizable expansion in gold output, as in the Thirties, is, however, a question to which last year's experience cannot give even a tentative answer.

2. Gold Leaves the U.S.

In contrast to the early postwar years when the United States absorbed the entire available output of gold outside the USSR, last year's foreign gold output remained abroad. It was too early at the time of writing to venture any estimate of the amount of newly mined gold that was added in 1950 to foreign monetary reserves. However, the central monetary reserves of foreign countries as a whole increased between October, 1949, and September, 1950, by some $1.6 billion, of which about 1.1 billion can be accounted for by purchases from the United States. (See Table II.) The difference of some $500 million seems to have originated in current production (assuming, subject to a qualification set forth below, that there was no net dishoarding), and since output outside the United States during the 12 months ended September, 1950, was worth somewhat over $750 million, a rough inference can be made that some 250 million, or one-third, was consumed by industry and the arts or disappeared into private hoards. There

Table II. World Monetary Gold Reserves

(IN BILLIONS OF DOLLARS)

	Dec. 1945	Dec. 1948	Sept. 1949	Dec. 1949	June 1950	Sept. 1950p
United States	20.1	24.4	24.8	24.6	24.3	23.6
All other countries[1]	13.7	9.0	9.0	9.3	9.9	10.6
International institutions[2]	...	1.5	1.5	1.5	1.6	1.6
World[1]	33.8	34.9	35.2	35.4	35.8	35.9

p Preliminary.

[1]Excluding USSR: partly estimated.

[2]International Monetary Fund and Bank for International Settlements. Totals do not necessarily add up because of rounding.

Source: Federal Reserve Bank of New York. For data for individual countries, see the *Federal Reserve Bulletin*.

are, however, at least two qualifications that should be attached to general estimates of this kind. First, unreported gold production also disappears in the free and black markets; and secondly, such gold as came out of hoards when prices were falling in the first half of 1950 was acquired by the monetary authorities, who sometimes set it aside in special reserves.

Besides some two-thirds of the current gold output, foreign countries also added to their monetary reserves such gold as they purchased in the United States. In the 15 months between the devaluations and December, 1950, foreign countries bought from the United States $1.8 billion worth of gold. These foreign purchases marked a sharp reversal of the previous years' sales, as a result of which the United States had received from abroad gold to a net total of $5.4 billion between the beginning of 1946 and the end of September, 1949.

Of the 1.8 billion of gold sold by the United States, some 350 million were sold during the nine months ended June, 1950, but about 1.5 billion during July to December, 1950. However, this acceleration in United States gold sales reflects to a large extent merely a more rapid conversion into gold of dollars acquired by foreign countries. It is common practice among foreign monetary authorities to convert into gold dollar balances that are in excess of customary levels, just as in the earlier postwar years they sold gold whenever they needed to replenish dollar balances that fell below such levels.[2] As a matter of fact, foreign countries' dollar assets increased by $2 billion from October, 1949, to September, 1950, although they purchased gold from the United States during these 12 months only to the extent of 1.1 billion. By buying and selling gold freely at a fixed price in transactions with foreign monetary authorities for all legitimate monetary purposes, the United States maintains an international gold bullion standard which enables the dollar to serve as a fixed point of reference for other currencies.

The recent pattern of gold transactions can, however, be better understood if account is taken not only of the gold reserves of central banks and governments but also of the dollar assets held in the United States on official and private foreign account. As can be seen from Table III, such assets increased from $14.7 billion in September, 1949, to 18.2 billion in September, 1950, or 24%. Of the $3.5 billion increase, 1.9 billion was accumulated during the nine months ended June, 1950, while 1.7 billion was added during the first three months after the outbreak of the Korean war. The rise in foreign gold and dollar assets has, however, been very unevenly distributed as between countries, with the sterling area, Canada, and Latin America accounting for the bulk of the increase.[3]

The rise in foreign gold and dollar assets, with the concomitant decline in the United States monetary gold stock and the increase in the United States short-term indebtedness to foreign countries, reflects the sharp reversal in the various balances of international payments that occurred last year. By the third quarter of 1950 the gap between United States exports and imports was nearly closed, in less than two years after the European Recovery Program had got well under way, and one year after the devaluation crisis of September, 1949. Fundamental factors such as increased production and productivity and the subsidence of inflation in a large number of foreign countries, together with the restoration of competitive efficiency, accounted for the reversal in the balances of payments in the first half of 1950. After the Korean outbreak at the end of June, 1950, however, special and extraneous circumstances, such as official stockpiling and private inventory accumulation at prices that in some cases attained all-time highs, gradually became more important.

By the end of 1950 many foreign countries were feeling the effects of United States rearmament, while the impact of their own rearmament had not yet become manifest. The ability of foreign countries to earn dollars and to preserve the gains in monetary reserves achieved last year thus remained untested at a time when the strain of accelerated rearmament seemed certain to affect adversely the balances of payments, monetary reserves, and general viability of Western Europe. It was because of these anticipated difficulties and burdens, which are certain to fall upon the British economy and balance of payments in 1951, that ERP aid to Britain was not terminated but merely suspended as from Jan. 1, 1951, with the understanding that the whole question would be reconsidered if necessary.

3. Gold Prices Fluctuate

As already noted, some $250 million worth of gold was probably absorbed last year by the arts and industry and by private hoards. Of this amount, about one-third was supplied by the Union of South Africa, which sold about one-fifth of its output on the free markets. The remainder seems to have originated partly in those producing countries that openly or tacitly permit sales of newly mined gold on the free markets, and partly in withdrawals from central monetary reserves.

South African producers were allowed in 1949 to sell semi-fabricated gold at a premium for use in industry and the arts, subject to various protective requirements laid down by the International

[2]Most of the gold sold was actually earmarked for foreign account at the Federal Reserve Bank of New York. Gold under earmark at the Federal Reserve Bank of New York for account of foreign central banks, including that held for the account of international institutions, amounted to $5,626 million on Dec. 29, 1950, as against 4,061 million on Sept. 30, 1949.

[3]For data regarding recent changes in gold and dollar assets of a number of foreign countries, see Federal Reserve Bank of New York, *Monthly Review*, Jan., 1951.

Monetary Fund's governing board.

The expansion of South African sales on the world free markets from the early months of 1949 onwards had, however, the effect of wiping out a sizable part of the premiums that had previously been paid for free-market gold. According to an official announcement, South African producers during the year ended March, 1950, realized from such direct sales an average premium of only 11% over the official gold price—i.e., these sales were only at about $38-39 per oz. fine. When in the second quarter of 1950 even this margin dwindled, sales of South African gold for industrial and artistic purposes became unprofitable and were practically discontinued, only to be resumed again when the price rose above $38 after the outbreak of the Korean war.

The changing fortunes of the Korean war were in turn reflected in sudden fluctuations in gold prices. As may be seen from Table IV, prices in Hongkong and Paris, which had fallen to $38-39 per fine oz. by mid-June, 1950, had risen to $42-$45 in December, 1950, and were still rising in January, 1951, as a result of gold hoarding stimulated by the accentuated international tensions and the anticipated inflationary impact of rearmament.

Table III. Gold Reserves and Dollar Assets of Foreign Countries

(IN BILLIONS OF DOLLARS)

	Dec. 1945	Dec. 1948	Sept. 1949	Dec. 1949	June 1950	Sept. 1950p
Sterling area[1]	4.1	2.9	2.4	2.7	3.5	4.0[a]
Switzerland	1.6	1.9	2.0	2.0	2.1	2.1
ERP countries other than United Kingdom and Switzerland[2]	6.2	3.6	3.7	3.8	4.0	4.2
Canada	1.7	1.2	1.3	1.4	1.5	2.1
Latin American republics[3]	3.8	2.7	2.9	3.1	3.0	3.3
Asia[4]	2.2	1.7	1.6	1.5	1.6	1.7
All other[4]	0.9	0.8	0.7	0.8	0.9	0.7
All foreign countries[4]	20.7	14.8	14.7	15.3	16.6	18.2[a]

p Preliminary.

[a]Including certain dollar assets held in specific trust accounts, previously not included.

[1]Including the United Kingdom, but excluding Eire and Iceland, which are included under "ERP countries."

[2]Including overseas dependencies.

[3]Excluding sterling, French-franc, and guilder areas.

[4]Including the short-term dollar balances, but not the gold reserves, of the USSR.

Note: The table covers reported gold reserves of central banks and governments (excluding the USSR), and official and private short-term and relatively short-term dollar assets held by foreigners in the United States (including the USSR). Gold and dollar holdings of the International Monetary Fund, the International Bank for Reconstruction and Development, and the Bank for International Settlements are excluded. Gold figures are partly estimated.

Source: Federal Reserve Bank of New York. For separate data regarding gold holdings of central banks and governments and short-term dollar balances on foreign official and private account, see the *Federal Reserve Bulletin*.

Table IV. Free-Market Gold Prices

	Hong Kong HK$ per tael	Hong Kong US$ per fine oz[1]	Bombay Rupees per tola	Bombay US$ per fine oz[2]	Alexandria E£ per dirhem	Alexandria US$ per fine oz[2]	Paris Francs per gram	Paris US$ per fine oz[2]
1947—December	303	50	103	83	172	71	530[a]	51[a]
1948—December	296	49	113	91	153	63	808	49
1949—Mid-September[b]	330	47	114	92	154	64	629	52
—December	291	39	114	64	169	47	580	46
1950—Mid-June[c]	262	38	113	63	151	42	440	39
—December	306	45	112	63	155	43	524	42

[1]Converted at the free-market exchange rate.

[2]Converted at the official exchange rate.

[3]Converted at "parallel" market rate.

[a]February, 1948.

[b]Prior to the currency devaluations.

[c]Prior to the outbreak of the Korean war.

What Free Prices Mean

Free-market gold prices, whenever expressed in United States dollars, are conversions of prices that actually are quoted in inconvertible foreign currencies. For most local-currency quotations, a variety of dollar equivalents can be obtained by converting the local-currency price at the various exchange rates (black market, free market, official market). It is often difficult, if not impossible, to know which rate properly should be used in calculating a realistic dollar equivalent. In the Far East, where gold premiums are highest, gold is the traditional form of saving, but dollar transactions are relatively few and unimportant; hence the so-called Far Eastern dollar prices of gold, which are the highest ones extant, lack realism. In Western Europe, on the other hand, gold hoarding is a function, not of prosperity, but of hope and fear, principally the latter; Western European free-market gold prices are therefore dominated by the speculative factors that are inherent in such a means of deriving private profit from anticipated or feared political or economic changes in Western European economies. In neither area, therefore, are the free-market gold prices any indication of its intrinsic dollar value.

The International Monetary Fund, which in 1947 recommended to all its members that they take effective action to prevent transactions in gold at premium prices with other countries, announced in May, 1950, that a change in its gold policy would be undesirable under existing circumstances.

Although the United States has shifted from a position of net gold buyer to one of net gold seller, the objections to an increase in the gold price have not lost their earlier force. There is no need, under the existing world-wide full employment coupled with rearmament, to draw scarce resources into the production of monetary wealth at the expense of the production of real wealth. Furthermore, in an inflationary environment, a higher gold price would greatly complicate the task of the monetary authorities in many countries in implementing policies of monetary restraint. Last but not least, a rise in the dollar price of gold cannot be a substitute for the measures, both domestic and international, that the Western nations will have to adopt, both at home and in the sphere of external payments, to deal with the present international emergency.

In doing this, the Fund rejected a South African proposal that producers be allowed to sell half their output on free markets at premium prices, with the rest to go to monetary authorities or to the Fund at the official price.

Silver Production

Production of silver by the following countries embraces a substantial percentage of the world's total. Figures are in thousands of troy ounces.

(American Bureau of Metal Statistics)

	United States(a)	Australia(b)	Canada(c)	Mexico(d)	Peru(e)
1947	36,053	7,227	12,504	49,198	10,783
1948	36,111	6,469	16,110	45,800	9,288
1949	34,559	5,765	17,641	49,500	10,609
1950:					
January	2,965	886	1,196	3,700	800
February	2,496	531	1,385	4,100	920
March	3,721	732	1,768	3,800	790
April	4,224	630	1,454	3,100	810
May	3,890	795	1,751	3,800	780
June	2,669	771	1,968	4,400	1,200
July	4,102	596	2,286	3,300	1,220
August	3,660	585	2,282(f)	4,000	690
September	4,222	541(f)	2,164	4,000	890
October	2,747	617		4,400	750
November	3,433				

(a) Includes domestic U. S. refined plus purchases of crude silver by U. S. Mint. (b) Refined silver production, excluding silver in products exported. (c) Mostly refined in Canada, but includes recoverable silver content of products exported, which amounted to 3,295,000 oz. in 1948 and 4,054,600 oz. in 1949. (d) Estimated in small part; includes silver content of products exported. (e) Partly estimated. Prior to 1949 this production was extensively duplicated in the output of foreign silver by refiners in U. S. A. (f) Revised.

Silver

» Mexico keeps grip on market, but yields to inflationary trend as year ends. Higher prices and increased industrial use are in prospect.

DICKSON H. LEAVENS, Colorado Springs, Colo.

THE TWO PRINCIPAL FACTORS in the silver market in 1950 have been Mexico and Cuba. As in 1949, the Bank of Mexico, controlling the disposal of the largest new production and one of the largest disposable accumulated stocks, has been able to determine the price by adjusting the quantities it has fed out to the market.

In July the Government of Cuba announced that it had decided to sell 80 million silver pesos which had been held as backing for paper currency. The Cuba peso is identical with the United States silver dollar in weight and fineness and this sum therefore represents about 62 million fine ounces.

Physical shipment of the coins to New York began in July, but sales have evidently been made only to the extent that the metal could be absorbed without breaking the price. Cuba and Mexico presumably are cooperating or at least not competing.

The New York official price opened in January, 1950 at 73¼c. per oz., 0.999 fine; it dropped to 72¾ and 71¾c. on March 29 and 30, and rose to 72¾c. on May 4, where it continued until autumn. On Oct. 23 it rose to 77¾c. and the following day to 80c.; the Bank of Mexico allowed this rise because of its shrinking stocks and because demand was sufficient to allow silver to share in the general inflationary trend. The United States Treasury's price for newly-mined American silver continued at the statutory rate of 90½c. per oz.

In London the price followed New York closely, beginning the year at 64d. and ending at 70d. Most silver for essential industries was supplied from official stocks derived from melting former silver coins. "Free exportable silver" commanded a varying premium over the official price.

The Bombay market, as for the past decade, continued insulated from the rest of the world, and was affected chiefly by conditions within India and by speculative activity. The price fluctuated between the equivalents of 96c. and $1.07 per oz. China had little to do with the world silver market this year.

Production figures, as far as available, are given herewith. United States production has been running about 20% above 1949.

Gross imports of silver have been about a third larger than in 1949 and net imports about double. This reflects the fact that in the former year considerable Mexican silver was imported to be coined and reexported to China, and that in 1950 Cuban silver has been arriving and accumulating in excess of consumption. Handy & Harman estimate net imports at 134 million oz. and domestic industries' consumption at 120 million oz.

The Treasury has continued to acquire all new domestic production, to the amount of over 41 million ounces at 90.5c. per oz. Of this, 70% goes into the reserve against silver certificates issued in payment and 30% into the General Fund, the so-called "free silver," which is drawn on for subsidiary coinage. During the first half there was little demand for more subsidiary coins and the mints cut their production. In July, coinage activity was resumed and the total for the year exceeded that of 1949. Thus, in spite of additions, the stock of "free silver" was reduced from 171 million ounces at the beginning of 1950 to 160 million at the end. No foreign silver was purchased by the Treasury.

Little was heard of silver during the second session of the 81st Congress. A subcommittee (on Monetary, Credit, and Fiscal Policies) of the Joint Committee on the Economic Report, under the chairmanship of Senator Paul H. Douglas, recommended that the Government cease buying silver for monetary purposes, on the ground that it was an unnecessary part of the currency system, that it was continuously expansionary and irreversible, and that even as a subsidy to producers it was defective in not being geared to changes in economic conditions. No action was taken.

Bills for repeal of silver-purchase legislation were introduced by Senator Green and Representatives Cellar and Forand. Senator McCarran made a counter attack with a resolution to investigate monopolistic practices of bullion brokers or fabricators of silver. None of these measures got out of committee.

Effects of the Present Conflict

Both the first and the second World Wars had important influences on silver. In the former there was a greatly increased coinage demand in many countries, especially India, where inconvertibility of Government paper currency was averted only by the passage of the Pittman Act of April 23, 1918, under which we melted 260 million silver dollars and sold the resulting 200 million fine oz. to India at $1.00 per oz. plus charges. The price of all silver was pegged at this figure until May, 1919; thereafter it rose rapidly as Chinese demand became the most important factor, and reached a peak of $1.37½ in November, 1919.

World War II began under somewhat different conditions as to silver. The U. S. Treasury had accumulated all the idle silver in the world and a considerable quantity that had formerly been in monetary use in China and elsewhere. Monetary demand, except for subsidiary coinage in the United States, was less than before. Government controls in India and England kept those markets insulated.

With shortages of copper, nickel, and tin, however, silver became a practicable substitute for some uses of these metals, and the industrial demand increased greatly. The 2,500,000,000 oz. in the Treasury became a useful stockpile. Nearly a billion ounces were loaned to war plants for temporary nonconsumptive uses as conductors of electricity, and 167 million ounces were sold under the Green Act of July 12, 1943, chiefly for industrial purposes.

Meanwhile Treasury purchases of both foreign and domestic silver practically ceased from 1942, so that all available new supplies went to industry. The price, however, was regulated by the Office of Price Administration, and did not rise as high as economic forces would have brought it.

Demand for small change greatly increased, and in the six fiscal years ended June 30, 1946, the Treasury used 361 million oz. to coin subsidiary silver and 49 million oz. in wartime five-cent pieces. Meanwhile other countries were needing silver for coinage, or, as in the case of India, for sale to hoarders as a brake on inflation, and we disposed of 411 million oz. under lend-lease.

With the nation now entering on a rigid defense economy, if not actual war, and with political considerations making a pay-as-you-go policy unlikely, there is bound to be more or less inflation, in which silver undoubtedly will share unless restricted by Government action. Moreover, there may be a renewal of the industrial demand which has fallen off somewhat since the war, and the demand for subsidiary coins, may increase despite the fact that per capita use exceeds $6.00.

To meet these demands there are, in addition to annual world production of something under 200 million oz. the following sources:

1. "Free silver" in the General Fund of the Treasury, amounting to only 160 million oz. as compared with 1,350 million oz. nine years ago. This can be sold to industry at 90.91c. per oz. under the Act of July 31, 1946.

2. Bullion in the silver certificate reserve, 1,578 million oz. Of this, 402 million oz. (technically this figure can include some of the "free silver") "are held by certain agencies of the Federal Government," representing the balance of that loaned for nonconsumptive uses; the Treasury report quoted does not reveal whether this is still in active use. In any case, the whole of the 1,578 million oz. could safely be lent for nonconsumptive uses, while remaining nominally the cover for silver certificates; and it would seem that the act of July 31, 1946, would be sufficient authority for such action.

3. Floating stocks of silver in the hands of other governments. These include the unsold balance of Cuba's 62 million oz., Mexican supplies, Indian Government holdings of 300 million oz. (not all yet refined from 0.500 fine coins), and British Government stocks from old coins. The last two items are in large part earmarked for return of lend-lease silver, but in case of need might be diverted temporarily to domestic uses. Mexico's holdings are reported earmarked for her own coinage.

Thus, while there is much less "free silver" available than a decade ago, there would seem to be sufficient physical quantities of the white metal to meet any emergency needs in 1951, provided suitable legislation is enacted to release it. The price will depend on inflationary conditions and Government action, but for a time any demand could be filled at 90.91c. from Government stocks under existing legislation. The rise in the price of foreign silver on Jan. 8, 1951, to 90.16c. means that it and newly-mined domestic silver will both be available to silver users on approximately equal terms.

Copper

» Panic buying absorbs all available metal. Output was increased. Price is "stabilized" voluntarily at 24½c. Government limits the civilian use to stretch supply. Large imports were essential during 1950.

H. H. WANDERS, Market Editor

INFLATIONARY PRESSURES stimulated activity in copper throughout 1950. A continuation of the abnormally easy credit policy of the Government, along with developments in Korea, resulted in what was generally characterized as one of the most trying periods in the history of the industry. The rate of activity in key industries consuming large tonnages of copper moved steadily upward.

If any uncertainty over the outlook existed as the year opened, it was soon dispelled by the excellent demand for both copper and copper products.

Consumers paid no attention to

Summary of 1950 Copper Statistics

Copper Institute (Figures in Tons)

UNITED STATES

Production:	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals 1950
Crude, primary	73,625	69,994	78,928	73,853	76,691	78,962	76,563	80,620	80,102	82,750	82,564	85,279	939,931
Crude, secondary	12,001	10,762	11,407	9,929	6,571	17,792	8,815	12,518	6,576	7,792	7,584	5,364	117,182
Totals	85,626	80,756	90,335	83,782	83,262	96,754	85,378	93,138	86,678	90,542	90,148	90,643	1,057,113
Refined	95,229	94,036	113,440	103,293	112,388	113,961	96,758	108,465	111,842	110,435	101,410	109,464	1,270,768
Deliveries, refined (a)	111,668	112,773	123,030	101,729	113,837	126,047	96,006	112,107	113,529	121,806	113,715	121,954	1,373,194
Stocks, refined (b)	101,070	77,472	60,276	57,028	51,020	50,327	48,290	50,952	58,748	56,945	51,805	49,040	.....

OUTSIDE UNITED STATES

Production:	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals 1950
Crude, primary	106,162	110,089	108,588	105,065	117,691	106,491	119,938	119,938	105,798	119,358	116,870	111,695	1,347,683
Crude, secondary	1,669	549	1,227	1,004	758	1,615	933	1,658	616	517	437	404	11,387
Totals	107,831	110,638	109,815	106,069	118,449	108,106	120,871	121,596	106,414	119,875	117,307	112,099	1,359,070
Refined	87,923	83,501	84,604	89,369	98,082	91,145	94,609	100,195	93,507	105,237	101,972	97,185	1,127,329
Deliveries, refined (a)	81,574	69,193	72,626	72,047	83,305	64,566	69,062	63,922	85,809	77,502	83,356	75,639	898,601
Stocks, refined (b)	142,971	144,893	148,455	150,444	144,650	136,482	140,366	157,541	133,379	135,712	137,096	139,919	.....

(a) Deliveries to fabricators. (b) Stock at end.

the soothing comment of high officials in Washington to the effect that the defense effort could be met without greatly disturbing the civilian economy. They recalled what happened in the prewar period of World War II only too vividly and decided to take no chances. It was like a "vote of no confidence."

Though the market advanced during the year from 18½c. to 24½c. per lb., delivered, price at all times was of no consequence to the buyer. Producers had a tough time holding down prices in the fear market. The threat of price control hung heavily over the industry throughout the last quarter of the year.

In the outside market, in which moderate tonnages of copper treated on toll passed into the hands of dealers, as high as 45c. per pound was paid. European buyers, who found it impossible to obtain metal from regular sources, paid 35c. per pound. Semi-fabricated copper, produced for "home" consumption in Chile and elsewhere, was offered to consumers at even higher prices.

Throughout the period of ever tightening supplies, the Government continued to take delivery of substantial tonnages of copper for its strategic stockpile. Stockpile buying of a private sort was apparent, particularly in the second half of the year. This "protective" buying must have diverted large tonnages into invisible stocks of semi-fabricated and fabricated copper products. In other words, most observers were convinced that the statistics, as usual, told only a part of the story.

Apparent consumption of copper in the United States rose to a new postwar high. The statistics of the fabricating division indicate that copper contained in products shipped to customers during 1950 totaled 1,440,895 tons, against 1,053,225 tons shipped in 1949. Fabricators' shipments, accepted as a better guide to use of copper than the deliveries by producers, during the last five years, in tons, were as follows:

	Tons
1950	1,440,895
1949	1,053,225
1948	1,394,307
1947	1,338,383
1946	1,231,225

Deliveries of refined copper by producers to fabricating plants during 1950 totaled 1,373,194 tons, which compares with 1,031,595 tons in the preceding year. However, total deliveries of copper in the United States, including metal shipped to the strategic stockpile, came to 1,590,418 tons.

World production of crude copper by foreign and domestic producers reporting to Copper Institute totaled 2,336,183 tons in 1950, which compares with 2,188,808 tons in 1949. Heavy demands and rising prices in the second half of the year increased output in the United States, Canada and Rhodesia. Production in Chile suffered somewhat because of several unscheduled work stoppages.

The copper tariff of 2c. per lb. was restored July 1, 1950. Hope that the 81st Congress would act on a measure to suspend the duty was not abandoned until late in the year. President Truman, at a news conference on Dec. 28, said he will recommend to the new Congress that the United States continue the suspension of the duty for the period of the emergency.

Reimposition of the duty brought on numerous complications in the matter of taking care of the 2c. added to the cost to domestic consumers without setting off another upward movement in prices that would only lead to trouble for all concerned. The American Brass Co. notified its customers on Aug. 21 that until further notice each invoice will show a supplemental charge covering the duty paid on the imported copper used in processing the material. The pricing policy of the fabricator became effective July 1, 1950. The company said, in part: We are unable to obtain sufficient quantities of domestic copper to meet the requirements of our trade and must therefore depend largely on foreign copper. At the present time, foreign copper imports bear this duty of 2c. a pound. Since we are not in a position to absorb the duty we are obliged to pass it along to our customers. If any legislation hereafter enacted suspends retroactively the import duty paid on foreign copper used in the fabrication of the material sold. . . . Seller will refund to buyer the amount of duty shown on the invoice as a separate charge.

Sellers of foreign copper to domestic fabricators also passed on the 2c. import duty without disturbing the base price, hoping all the time that this would be a temporary move.

Total imports of copper during 1950, based on figures available for the eleven months ended November, probably exceeded 625,000 tons. This compares with imports of

Copper Production by Countries

American Bureau of Metal Statistics (Figures in Tons)

	Year 1949	Jan. 1950	Feb. 1950	Mar. 1950	April 1950	May 1950	June 1950	July 1950	Aug. 1950	Sept. 1950	Oct. 1950	Nov. 1950	Dec. 1950
United States (a)	772,986	73,625	69,994	78,928	73,853	76,691	78,962	76,563	80,620	80,102	82,750	82,564	85,279
Canada (refined)	225,807	19,542	18,661	22,115	19,529	21,321	21,666	17,874	19,980	18,932	20,905	19,241	.....
Mexico (crude)	59,750	6,314	4,539	5,009	5,330	5,104	4,744	4,297	5,655	5,129	5,627	5,373	.....
Chile (b)	386,617	30,343	30,075	26,350	25,329	35,946	23,389	36,354	38,040	28,354	.....	.....	.....
Peru (refined)	22,990	1,976	1,681	1,788	1,901	1,875	1,875	1,710	2,234	1 961	.....	.....	.....
Germany (d)	160,310	17,653	15,044	17,589	16,870	16,655	17,776	19,186	16,875	17,745	18,882	.....	.....
Japan (refined)	81,611	6,416	6,823	6,381	7,475	7,749	7,972	7,771	7,894	8,412	8,882	.....	.....
Australia (crude)	11,235	190	1,240	1,480	1,740	1,504	1,592	1,385	1,951	1,428	.....	.....	.....
Union of S. Africa (c)	32,545	2,546	2,914	3,527	3,409	3,162	2,270	2,126	3,562	3,687	.....	.....	.....
Rhodesia (crude)	289,946	23,329	21,653	23,825	27,282	27,720	27,885	27,728	27,739	25,626	25,916	29 061	.....
Belgian Congo	155,864	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)	(f)

(a) Blister or converter copper reported by Copper Institute as "mine or smelter production or shipments, and custom intake." Does not include production from scrap nor from smelting of imported ore except that received from Cuba and the Philippines. (b) Reported as bar copper (includes blister, electrolytic and fire-refined). (c) Blister and fire-refined. (d) Refined Copper, both electrolytic and fire-refined, includes scrap. (f) Not available on monthly basis.

545,898 tons in 1949. Imports of primary metal in the Jan.-Nov. period of 1950, in tons, according to major classifications listed by the Bureau of the Census:

	Jan.-Nov. 1950
Copper in ore, etc.	93,949
Copper in blister	197,557
Refined copper	291,943

In addition to the heavy imports of primary metal, the United States drew on foreign sources for approximately 70,000 tons of copper contained in old and scrap copper-bearing material.

Net imports were reduced, however, by the exportation of about 135,000 tons of refined copper during 1950. Substantial tonnages moved out of this country consisted of metal recovered from copper-bearing material, chiefly crude, treated at domestic refineries on toll. Imports of blister from Rhodesia alone amounted to more than 75,000 tons.

To meet the expanding use of copper, refinery capacity was increased here and abroad. Extensions to the electrolytic refinery of Rhodesia Copper Refineries Ltd. were completed and will be in production early in 1951. The electrolytic refinery of Kennecott Copper Corp., constructed at Garfield, Utah, at a cost of $16,000,000, was dedicated Nov. 15. Capacity of the new refinery is 12,000 tons a month.

Early in December the National Production Administration announced that use of copper for non-military purposes will be reduced 15% in January and February, and 20% in March of average monthly consumption during the six months' base period ended June 30, 1950. The order restricting the use of copper was issued to assure an adequate supply for the expanding defense program. William H. Harrison, administrator of NPA, declared that despite everything which can be done, there is little likelihood that supply can be increased appreciably in the immediate months ahead.

Restrictions on use of copper also were announced for the United Kingdom. The British Ministry of Supply informed consumers that effective Jan. 1, 1951, and until further notice, consumption will be restricted to a total each month equal to the average monthly consumption in the first half of 1950.

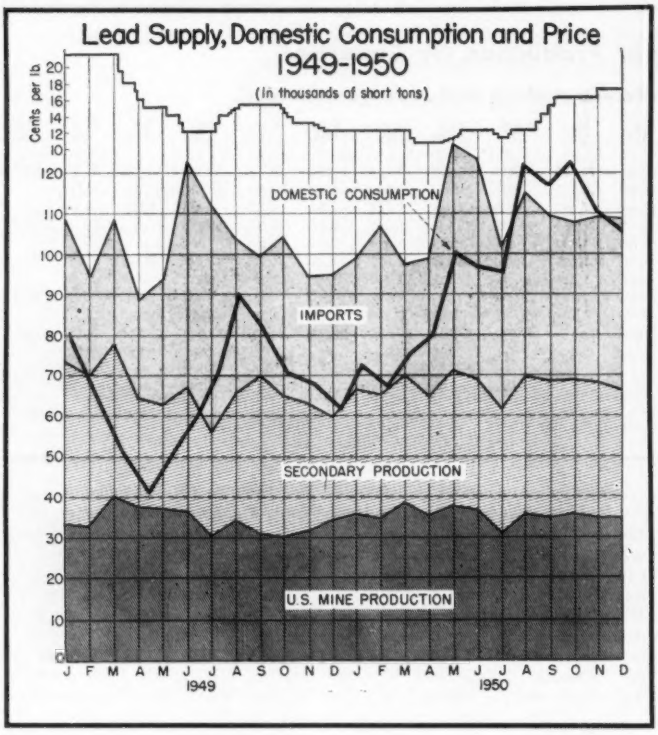
Late in December, the authorities in this country amended the copper order (M-12) to restrict the end use of copper in a long list of civilian products, effective March 1. This version of the order virtually limits the use of copper in the United States to products that serve a functional purpose and for which no substitute is available. It prohibits use of the metal in various building materials, hardware, clothing and dress accessories, furniture, appliances, novelties and jewelry, and numerous miscellaneous materials. All told, some 300 items were hit by the order.

Whether copper producers would get a "fair deal" on the all-important subject of pricing the metal was a top subject toward the close of the year. The possibility of a rollback in the price appeared as a real threat to the industry. The Economic Stabilization Agency called for a meeting of copper executives and government officials on Jan. 3, 1951, to discuss price control. As the meeting ended, it was announced that the consensus was that no action should be taken in the matter of placing a price ceiling on primary copper, since the price of this metal is stable at present. The head of the agency concurred in this view upon receiving assurances from members of the industry that they would not advance their prices without first notifying the ESA of any such action should it be contemplated at any future time.

In reference to the pricing of copper, the present situation cannot be compared with that of World War II. Competition for copper produced outside of the United States is increasing and much copper may be lost to this market without a liberal pricing policy. Officials in Washington are well aware of the fact that they have no jurisdiction under prevailing conditions to control the price of copper in the world market.

Control of distribution of copper and other critical materials through a combined allocation board was discussed, chiefly on the insistence of countries in the North Atlantic Treaty who have found it almost impossible to obtain adequate supplies because of the extraordinary demands of United States buyers.

The outlook for copper for 1951 is totally obscured by the international political crisis. A healthy home economy is absolutely necessary to pay for the defense program, so curtailment in civilian use may not be drastic. President Truman's budget for the next fiscal year assures a ready market for all of the copper in sight.


Lead Supply, Domestic Consumption and Price
1949-1950
(In thousands of short tons)
Cents per lb
DOMESTIC CONSUMPTION
IMPORTS
SECONDARY PRODUCTION
U.S. MINE PRODUCTION
J F M A M J J A S O N D J F M A M J J A S O N D
1949
1950

Lead

» **Both lead supply and consumption hit all-time highs in 1950. Increased use of lead as substitute for scarcer metals seen as a possibility for the future.**

ROBERT L. ZIEGFELD, Secretary, Lead Industries Association, New York, N. Y.

NEEDLESS TO SAY, world events in 1950 had a profound influence on lead, as they did on virtually every other commodity. Whereas during most of the first half of the year supplies of lead more than balanced demand, after the Korean conflict started, the situation was reversed. Consumption in the last half of the year increased remarkably and the price was strong. This is not to say that Korea alone was responsible for the great upswing in demand. Consumption probably would have increased anyway, but not so markedly. However, the lead supply situation, even with the strengthening in the second half, never became critical in 1950, as did the supplies of other metals.

A study of the accompanying chart pretty well explains what happened to lead during the year. In studying this chart it should be borne in mind that some 100,000 tons of lead went to Government stockpile in the first six months, which must be added to the industrial consumption shown. As of July 1, the Government ceased its stockpile purchases of lead and announced that its objectives had been revised downward and that its needs had been virtually satisfied.

It can be seen that even allowing for stockpiling, supplies exceeded demand in the first three months of the year and the price dropped from 12c. per lb. on January 1 to a low of 10.5c. on March 14. In April there was no excess of lead and the price returned to 12c. by May 11. However, again in May and June supplies exceeded demand and the price dropped to 11c. by June 28. Then beginning with July, when stockpiling ceased, industrial demand equaled or greatly exceeded supplies. Consequently starting July 12 the price began to rise by steps to 17c., which it reached on October 31.

All-Time Records

As nearly as can be estimated, both lead supplies and lead consumption in the United States reached all-time highs in 1950. Total supplies, including reduction in refiners' inventories, should exceed 1,350,000 tons. Industrial consumption, including a moderate increase in manufacturers' inventories, exceeded 1,220,000 tons. The difference is accounted for by stockpiling. Lead apparently was in close balance over the year with some shift of inventories from producers' to users' hands.

Mine production in the United States reached the highest level since 1943 and was at least 425,000 tons. This was about 100,000 tons greater than the 1946 low. It reflects an adequate labor supply during most of the year and the fact that exploration and development were catching up after the long deferment of this work during the depression and World War II.

It is significant that labor supply showed signs of tightening near the year-end and may become a serious problem in the months ahead. This may retard further expansion of mine production in 1951, particularly at some properties where new development work and new facilities are just reaching a point to permit mining greater tonnages. The Metaline District in the State of Washington is a case in point, as it appears likely that the district could increase its production of lead and zinc materially in the future. New production in the Coeur d'Alene district of Idaho may also be affected, as well as some of the reopening older mines in Utah and elsewhere.

Production from scrap in 1950 was about 390,000 tons, slightly higher than it was in 1949. But imports of lead reached what may

Table I. Lead Price Changes

Cents per lb., New York[1]

Nov. 21, 1949	12.00
Mar. 9, 1950	11.00
Mar. 14, 1950	10.50
Apr. 20	10.75
Apr. 26	11.00
May 4	11.25
May 10	11.50
May 11	12.00
June 23	11.50
June 28	11.00
July 12	11.50
July 13	12.00
Aug. 15	13.00
Aug. 21	14.00
Sept. 1	15.00
Sept. 8	16.00
Oct. 31	17.00

[1]Engineering & Mining Journal.

Table II. U.S. Lead Supply and Demand

SUPPLIES	1949[2]	Estimated 1950
From:		
Domestic Ores	409,908	425,000
Foreign Ores and Base Bullion	109,713	70,000
Secondary	384,337	390,000
Imports of Metal	275,240	425,000
Total	1,179,198	1,310,000
Change in stocks at primary smelters and refineries	54,772(Incr.)	60,000(Decr.)
Total	1,124,426	1,370,000
DEMAND		
Industrial Consumption	868,450	1,210,000
Change in consumers stocks	15,800(Decr.)	15,000(Incr.)
Total	852,650	1,225,000
Apparent excess of supply over demand[3]	271,776	145,000

[2]American Bureau of Metal Statistics, U. S. Bureau of Mines, Lead Industries Association. [3]Includes lead purchased for government stockpile.

Table III. U.S. Lead Consumption

	1949[4]	Estimated Full Year 1950	Percent Increase 1950 Over 1949
White Lead	20,600	35,000	70
Red Lead and Litharge[5]	48,600	90,000	85
Storage Batteries	280,600	405,000	44
Cable Covering	130,100	140,000	8
Building[6]	48,200	67,000	39
Tetraethyl	101,700	110,000	8
Ammunition	18,000	36,000	100
Foil	2,700	3,000	11
Bearing	26,600	32,000	20
Solder	58,300	95,000	63
Typemetal	25,000	31,000	24
Calking	33,800	60,000	78
Unclassified	73,800	106,000	44
Total	868,000	1,210,000	39

[4]American Bureau of Metal Statistics.
[5]Exclusive of oxides for storage batteries.
[6]Chiefly pipe, sheet and extrusions. Includes lead used in chemical construction.

be an all-time high of some 495,000 tons, equaling or perhaps exceeding a like figure in 1942, when European markets were cut off by war from most foreign producers who had no place left to ship but the United States. Imports in 1950 surpassed 1949 imports when lead entered duty-free during the first half of the year by some 110,000 tons, despite a moderate drop in imports of ore and base bullion.

On the other side of the ledger, industrial consumption also made a record of about 1,210,000 tons, bettering all war years and the previous high of 1,172,000 tons reached in 1947. Considering that perhaps 100,000 tons went to stockpile, it is quite remarkable that industry was able to get such a huge amount of lead. Industrial consumption was thus nearly 40% higher than the relatively poor year 1949, and total consumption, including stockpiling, was up about 20%.

All of the major uses of lead showed marked increases in 1950, compared with 1949. Oxides for use other than in batteries was the leader in this respect, increasing about 85%. Among other things, this probably reflects the growing preference for red lead paints, noticeable particularly in recent Navy paint formulations. Other uses showing greater than average increases were calking lead, solder, white lead, ammunition storage batteries and building. Tetraethyl lead showed only a moderate increase of 8%, but this resulted from the fact that i, alone among the uses of lead also showed an increase in 1949 over 1948. In other words, the use of lead for antiknock compounds has been constantly on the increase, with considerable new capacity coming into production during the past two years and more to come in 1951.

Despite all this, lead supplies appeared adequate to satisfy consumers and the Government. While the National Production Authority late in the year issued orders restricting the use of many metals, no such orders were issued relating to lead. Lead, except lead scrap, was omitted from the general inventory control regulation when first issued, but was included in the anti-hoarding order issued just before the year-end. In fact, substitution of lead for scarcer metals was being encouraged as in World War II.

It seemed quite clear that at least a good part of the heavy buying of lead in the last half of the year resulted in attempts of dealers and users of lead products to build up inventories against possible future shortages and need on the part of lead manufacturers for larger working inventories.

During the year the United States Government abrogated the Reciprocal Trade Agreement entered into with Mexico in 1943, the abrogation to be effective as of Jan. 1, 1951. This was the agreement which lowered the lead tariffs from the 1930 rates of 1½c. per lb. on ore and concentrates and 2⅛c. per lb. on pig lead to half those amounts or ¾c. on ore and concentrates and 1-1/16c. on pig lead. Under the most favored nation principle these lowered rates have been applicable to all countries exporting lead to

the United States since 1943. However, on Jan. 1, 1951, the old rates went back into effect for all countries and some confusion entered the lead market.

For shipment after Jan. 1, 1951, lead produced in the United States continued to be quoted at 17c. per lb., but those consumers who bought foreign lead were asked to pay 17c. plus 1½c. of the duty, the producer or importer absorbing the balance of the duty or ⅝c. per lb. Thus in effect a two-price system prevailed with domestic lead costing consumers 17c. and foreign lead 18½c.

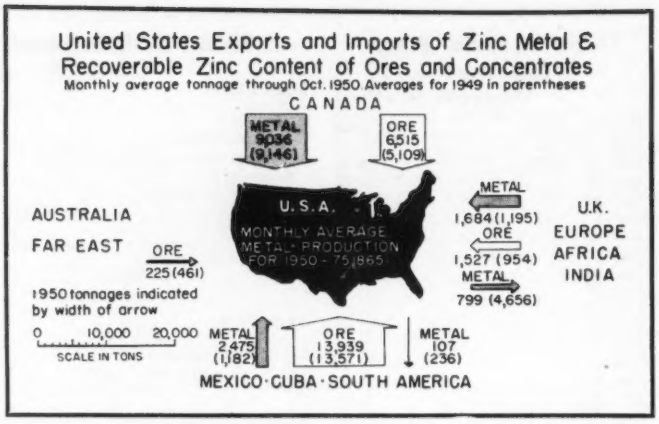
Outlook Strong

At the year-end the whole lead picture was clouded by events over which the lead industry has no control, lead not being unique in this respect by any means. In fact, up to this writing lead appeared in a favorable position compared with other metals. In general, mine development here and abroad was in good shape to permit satisfactory production if labor forces and supplies and equipment are in adequate supply. Competition for foreign lead may be more keen as dollar shortages abroad dwindle and foreign countries take more lead. Also stocks of lead at refineries abroad have no doubt been worked off to a point where they cannot be reduced much farther.

Storage batteries are the principal sources of scrap and about 80% of all the lead consumed in making batteries returns to the market as scrap two or three years later. The years 1947 and 1948 were record years for use of lead in battery manufacture. Batteries made then should be finding their way back into the market before long to assure a good supply of scrap.

Many unpredictable things may affect lead consumption. What effect shortages of other materials may have on the consumption of lead as a substitute is hard to tell. Tin restrictions may increase the lead content of such products as solder and babbitt metal. Tin and zinc shortages may increase the use of lead for coatings on steel. Copper shortages may mean more lead in plumbing and water distribution installations. Lack of aluminum may mean more lead for cable sheathing, collapsible tubes and foil. These are a few examples.

On the other hand, other shortages may reduce the consumption of lead by curtailing production of articles in which lead is used, for example, automobiles.



Zinc

»Smelter output for 1950 sets record for peacetime year. Some easing of tight supply is possible.

CHARLES R. INCE, Manager of Metal Sales, St. Joseph Lead Co., New York.

IN 1950 THE ZINC MARKET completed a cycle which started in 1948. There was a marked similarity between the situation which existed at the end of last year and that existing in the closing months of 1948. Then, as now, smelter stocks were at the year's low and consumer's stocks were less than a month's supply. Demand was running well in excess of supply and the official price was being held at 17.5c. per pound despite offerings in the "outside" market at substantial premiums. In the interim the market had passed through the "loop" phase of the cycle. In 1949 due to a decline in consumption, withdrawing of the Government from stockpiling with consequent increase in both producers and consumers stocks, the price in June had dropped to a low of 9c. per pound. Grave misgivings expressed at that time as to the adverse effect of that price level on domestic mine production have since been justified by the acute shortage of concentrates which developed during 1950, resulting in a decline of producers' and Government owned stocks of nearly 100,000 tons of zinc content for the year.

To understand the cycle the zinc market underwent from the close of 1948 through 1950 one needs to review briefly the supply-demand balance in the intervening year. In 1949 U. S. smelters produced 870,000 tons which, coupled with imports of 127,000 tons, provided supplies of 997,000 tons against which demand, as represented by domestic consumption, exports and shipments to Government stockpile, totaled only 852,000 tons, leaving a surplus of 145,000 tons. However, at the end of 1949 prospects for improvement in the zinc market were good. Industrial activity had resumed its upward swing after the interruption caused by the coal and steel strikes. The Federal Reserve Board's index of Industrial Production was 179 compared to 166 at the beginning of the last quarter and business appeared to be on the uprise.

In the first six months of 1950 domestic consumption and Government stockpiling exceeded available supply by about 10,000 tons a month. Fortunately, smelter stocks were available to absorb the deficit; nevertheless, the price rose steadily from 9.75c. to 13.00c. by June 1. In June, due to accelerated Government stockpiling, demand for zinc outstripped supply and the price moved from 13.00c. to 15.00c.

During the second half of 1950 after outbreak of the Korean war, the Industrial Production index moved up over 215 as compared to 188 average in the first six months. Demand for zinc continued to increase and, with smelter stocks liquidated to an irreducible minimum of around 9,000 tons, the official price moved rapidly to 17.5c. by early September. There it held steady for the balance of the year due to producers' restraint in the interests of an orderly market, despite the fact that commodity market metal and the "gray market" were quoted at premiums of 10.00c. to 30.00c. per pound. For the year as a whole, demand exceeded supply by close to 50,000 tons. See Table I on this page.

Table I. Comparison of Supply and Demand

SUPPLY		DEMAND	
1949			
Domestic production (Including secondary)	870,000 Tons	Domestic consumption	703,000 Tons
Imports	127,000 Tons	Export & Drawback	57,000 Tons
		For Government account	92,000 Tons
Total	997,000 Tons		852,000 Tons
		Surplus	145,000 Tons
			997,000 Tons
1950			
Domestic production (Including secondary)	910,000 Tons	Domestic consumption	*960,000 Tons
Imports	*156,000 Tons	Export & Drawback	*20,000 Tons
		For Government account	*130,000 Tons
Total	1,066,000 Tons		1,110,000 Tons
Deficit	44,000 Tons		
	1,110,000 Tons		

*Estimated—based on latest figures available.

Smelter Output Is Large

In 1950 domestic smelters turned out the largest tonnage of metal in history, barring the war years of 1942 and 1943 (see Table II). The production of 910,000 tons exceeded the previous year's total by 40,000 tons. Smelter production would have been higher if capacity had been fully utilized, but strikes at two of the smelters and shortage of concentrates in some sections of the country prevented capacity production. It is estimated that 950,000 to 1,000,000 tons of metal can be turned out in 1951 if concentrates are available. With domestic mine production totaling over 650,000 tons of zinc content, we will have to continue to import a substantial quantity of concentrates. Nearly 400,000 tons of imports would be required in 1951 to maintain capacity smelter production and take care of the 100,000 tons a year required for the manufacture of American Process zinc oxide. This is becoming increasingly difficult as the domestic price now stabilized at 17.5c is well below world markets and precludes domestic smelters from bidding competitively for foreign concentrates. At the end of 1950 the British Ministry of Supply was paying premiums of 4c. to 6c. a pound over the U. S. price for metal on the Continent. The same thing is true of metal imports which totaled about 160,000 tons, exceeding the previous year's imports by over 30,000 tons. If the world market continues at a level above the domestic price, imports which have been available to this country will be diverted to the higher market.

While zinc consumption normally varies directly with industrial production, this was not true in 1950. As shown by Table III, consumption exceeded 950,000 tons, the highest tonnage in history and was 34% greater than the previous year, whereas, the industrial index only went up from 176 to 200, or about 14% increase. This may be due in part to building up inventories of zinc-containing consumer goods, but primarily was a result of a greater utilization of zinc as a material of manufacture. For example, the use of zinc in die casting reached a new all-time high of 284,000 tons, an increase of 41% over the previous year. Undoubtedly, most of this increase was due to the advantages of zinc die casting as a high-speed, low-cost production tool backed up by the assurance of top quality castings under the Certified Zinc Alloy Plan sponsored by the American Die Casting Institute.

Table II. Total Slab Zinc Smelter Output (All Grades)

1950, TONS OF 2,000 LBS.

1950	Production	SHIPMENTS Domestic	Export & Drawback	Gov't Acc't	Total	Stock at End
Jan.	69,948	69 020	402	12,710	82,132	82,037
Feb.	69,639	72,843	768	10,646	84,257	67,419
Mar.	77,946	74.700	627	10.262	85,589	59,776
Apr.	75,877	73,389	397	9.347	83,133	52,520
May	79,645	71,101	209	19,036	90,346	41,819
June	75.766	68.214	422	22,284	90,920	26,665
July	77.868	67,119	371	16,626	84,116	20,417
Aug.	73.399	69,073	2,893	7,399	79.365	14,451
Sept.	71,057	70.656	2,580	2,005	75,241	10,267
Oct.	79.997	71,596	4.277	5,283	81,156	9,108
Nov.	79,226	69,202	3,702	6,175	79,079	9,255
Dec.	80,007	72,276	1,541	6,483	80,300	8,962
	910.375	849.189	18,189	128.256	995.634	
Monthly Average	75,865	70,766	1,516	10,688	82,970	

Table III. Consumption of Zinc by Industries

IN TONS*

	1949	1950	Change by Previous Year
Galvanizing	351,000	438,000	+25%
Die casting and zinc-base alloys	202,000	284,000	+41%
Brass products	86,000	137,000	+59%
Rolled zinc	55,000	67,000	+22%
Zinc Oxide and other uses	18,000	28,000	+56%
Totals	712,000	954,000	+34%

*Bureau of Mines figures with last two months of 1950 estimated.

Zinc used in galvanizing totaled 438,000 tons, an increase of 25% over 1949. This is not surprising as the steel industry, barring a slight interruption due to the abortive coal strike, operated at a peak rate throughout the year and shipped nearly 2,500,000 tons of galvanized sheet as compared to 1,800,000 tons in 1949. Zinc used in brass products totaled 137,000 tons for a gain of 59%. This was mainly due to a greater use of primary metal in place of zinc-bearing scrap. Unlike 1949 when the brass mills were deluged with brass scrap, zinc and copper-bearing scrap was extremely tight throughout most of 1950 as a result of the "outside" premium markets for both metals. Rolled zinc consumed 67,000 tons of the available supply, reflecting an increase of 22% over 1949, part of it as a result of the step-up in military orders for dry-cell batteries in the last half of the year. French Process zinc oxide production which had been adversely affected by strikes the previous year, rebounded with an increase of 56% requiring a total of around 28,000 tons.

NPA Curtails Uses

As the year ended all of these uses appeared headed for a marked curtailment. In December the National Production Authority issued a limitation order cutting the use of zinc and zinc products to 80% of the first 6 months of 1950, effective Jan. 1. Since consumption during that period was running at the rate of 77,000 tons per month compared to 88,000 tons during the last quarter of the year, the cut will be a reduction of 25% from recent rates of consumption. It is estimated that as much as 25,000 tons of zinc a month will be made available for DO's and Government stockpiling by the end of the first quarter of 1951 when users will have built up to the 45-day inventory permitted in the order.

From present indications, DO's will take a negligible part of this tonnage during the first six months due to the delay in placing defense orders and the time lag between placement of such orders and actual processing of the basic materials. There have been recent indications that the Government may not contract for additional shipments of zinc to the stockpile during the first half of 1951. Under these circumstances, it is conceivable that a surplus will develop unless the limitation order is relaxed to permit a greater use for civilian items. Much can be said in favor of such a course of action. If there is to be a hiatus between curtailment of civilian uses and the taking up of the slack by defense orders, it is far better to keep plants operating and their personnel intact.

If, on the other hand, there is no relaxation of the order and a freer supply should develop, an increase in exports might go far to alleviate the tight situation abroad and reduce, if not eliminate the premiums in the world market which at present constitute a real threat to our ability to procure the necessary concentrate imports which will enable full smelter production in this country.

The foregoing appraisal of developments in the near future are predicated on certain premises that may not materialize. However, for the long pull, it looks as if zinc will be in fairly tight supply as increasing DO's should ultimately take up the slack and zinc production may be adversely affected by manpower shortages, signs of which are already developing in the Western mining areas.

Tin

» Political tension in producing areas of Far East sets off hectic buying movement. Price is at record levels. United States restricts consumption

H. H. WANDERS, Market Editor

THE BEHAVIOR OF THE TIN market during 1950 confounded the experts. After six months of general price unsettlement because of the threat of a mounting surplus, the Korean developments set off one of the wildest upward price movements in the history of so important a world commodity as tin.

The 1950 monthly averages for prompt delivery Straits quality tin in the New York market speak for themselves:

STRAITS TIN, NEW YORK
(Cents Per Pound)

January	76.070	July	89.715
February	74.352	August	102.194
March	75.694	Sept.	101.250
April	76.430	October	113.420
May	77.495	November	137.217
June	77.688	December	144.940

As the year ended, Straits quality tin was quotable at $1.51 per pound. During November, the top price asked was $1.70 per lb. A sinking spell soon resulted in offerings at $1.30 and even less, all within a few days. Needless to say, prices established late in 1950 were by far the highest on record.

In replying to the question—What has caused such a chaotic market?—C. A. Ilgenfritz, vice president of purchases U. S. Steel Corp., said:

"Some observers advance the following reasons: (1) Panic buying because of disturbances in Indo-China and the fear that supplies from Southeast Asia might be cut off; (2) increased stockpiling activities on the part of foreign countries; (3) stockpiling by the United States; (4) speculative operations in London; (5) increased requirements throughout the world, especially in the United States."

World mine production of tin in 1950, based on preliminary figures, totaled around 164,000 long tons, which compares with 162,300 tons in 1949. Malaya's mine output came to 57,500 tons during 1950, which compares with 54,900 tons in 1949. Indonesia contributed 32,100 tons to the world's total, against 28,965 tons in the prior year. Bolivia exported the equivalent of 30,000 tons of tin in 1950, which compares with 34,117 tons in the preceding year. Production in the Belgian Congo totaled around 14,000 tons.

Smelter output for the world was estimated at 167,000 tons in 1950, against 169,000 tons in 1949. The Longhorn smelter in Texas produced 32,136 tons of tin in 1950, which compares with 36,053 tons in 1949.

World consumption of primary tin in 1950 was estimated at 142,000 tons, of which the United

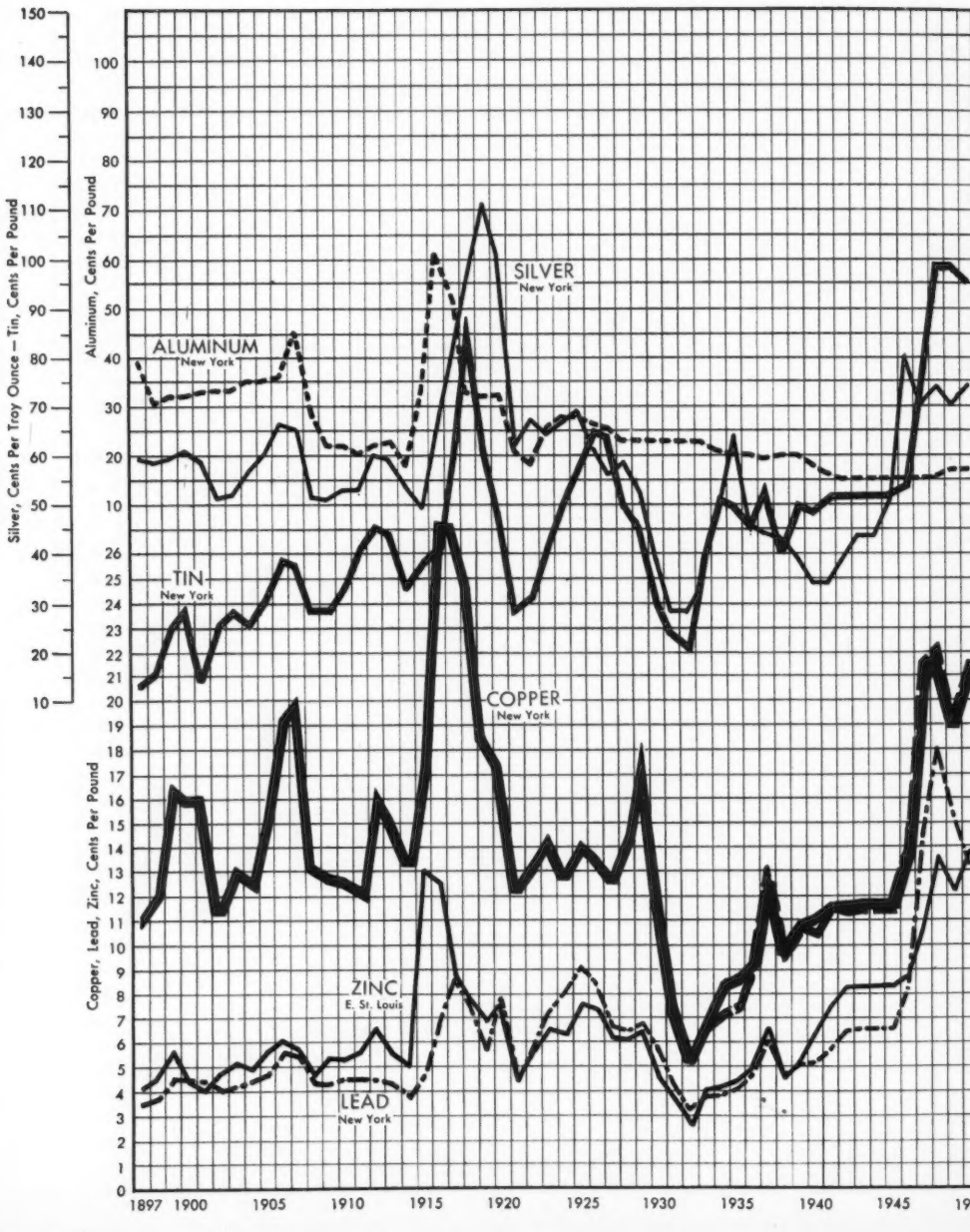
(*Continued on page* 88)

E & M J Me

As Published in Engineering and Mining Journ

McGraw-Hill Publishing

Annual Averages — 1897-1950



etal Prices

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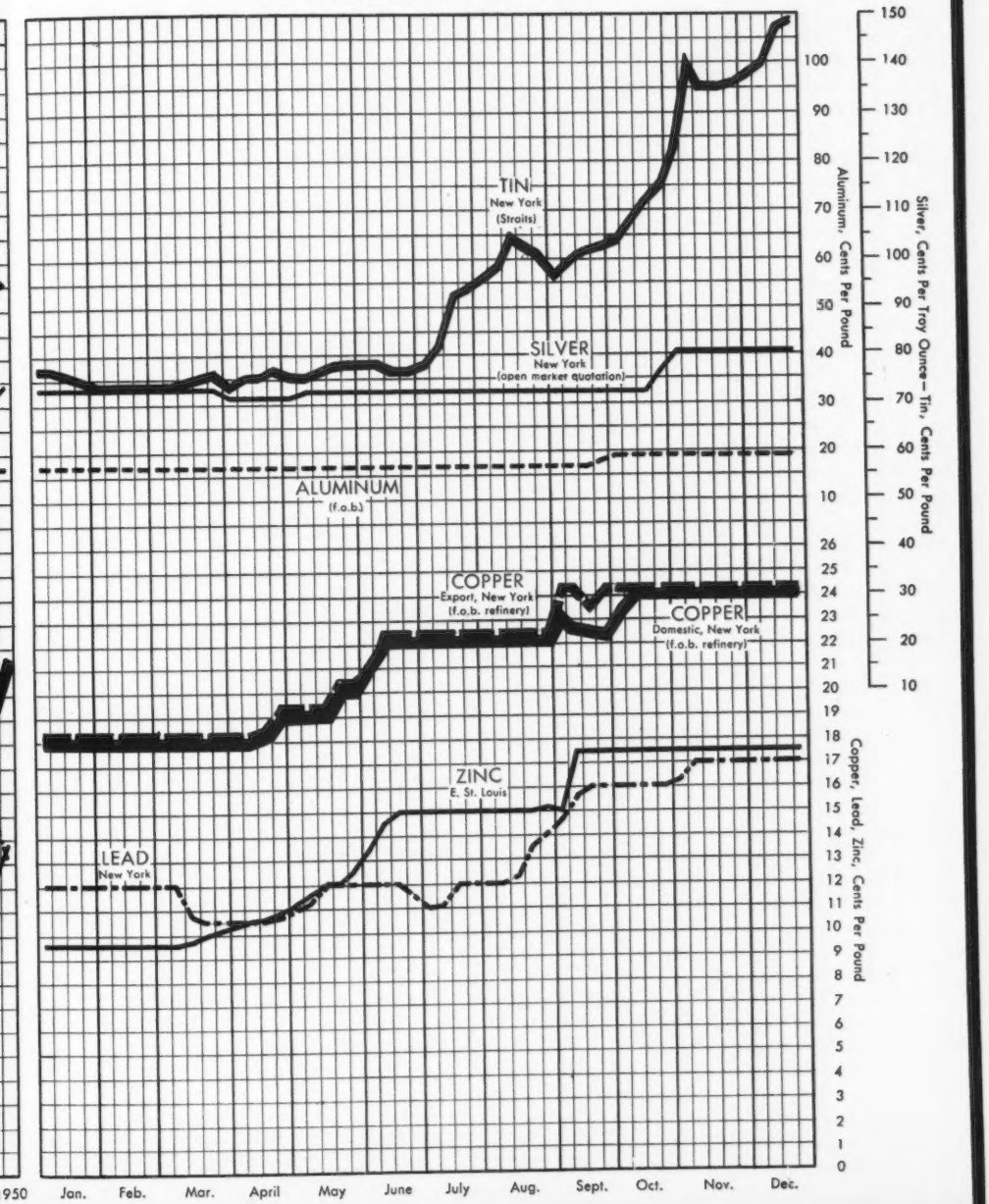
Company, Inc., New York

Weekly Averages – 1950



Silver, (e) New York
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43.225
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Silver N. Y., Foreign
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E & M J Annual Average Metal Prices — 1897 to 1950

Year	Copper (a) Electrolytic Refinery	Lead Common, New York	Zinc, Prime Western (b) E. St. Louis	Tin, (c) New York	Silver, (e) New York
1897.....	11.29	3.580	4.120	13.67	59.790
1898.....	12.03	3.780	4.570	15.70	58.260
1899.....	16.67	4.470	5.750	28.12	59.580
1900.....	16.19	4.370	4.390	29.90	61.330
1901.....	16.11	4.330	4.070	16.74	58.950
1902.....	11.826	4.069	4.840	26.79	52.160
1903.....	13.235	4.237	5.191	28.09	53.570
1904.....	12.823	4.309	4.931	27.99	57.221
1905.....	15.590	4.707	5.730	31.358	60.352
1906.....	19.278	5.657	6.048	39.819	66.791
1907.....	20.004	5.325	5.812	38.166	65.237
1908.....	13.208	4.200	4.578	29.465	52.864
1909.....	12.982	4.273	5.352	29.725	51.502
1910.....	12.738	4.446	5.370	34.123	53.486
1911.....	12.376	4.420	5.608	42.281	53.340
1912.....	16.341	4.471	6.799	46.096	60.835
1913.....	15.269	4.370	5.504	44.252	59.791
1914.....	13.602	3.862	5.061	34.301(d)	54.811
1915.....	17.275	4.673	13.054	38.590	49.684
1916.....	27.202	6.858	12.634	43.480	65.661
1917.....	27.180	8.787	8.813	61.802	81.417
1918.....	24.628	7.413	7.890	88.750	96.772
1919.....	18.691	5.759	6.988	63.328	111.122
1920.....	17.456	7.957	7.671	48.273	100.900
1921.....	12.502	4.545	4.655	29.916	62.654
1922.....	13.382	5.734	5.716	32.554	67.528
1923.....	14.421	7.267	6.607	42.664	64.873
1924.....	13.024	8.097	6.344	50.176	66.781
1925.....	14.042	9.020	7.622	57.893	69.065
1926.....	13.795	8.417	7.337	65.265	62.107
1927.....	12.920	6.755	6.242	64.353	56.370
1928.....	14.570	6.305	6.027	50.427	58.176
1929.....	18.107	6.833	6.512	45.155	52.993
1930.....	12.982	5.517	4.556	31.694	38.154
1931.....	8.116	4.243	3.640	24.467	28.700
1932.....	5.555	3.180	2.876	22.017	27.892
1933.....	7.025	3.869	4.029	39.110	34.727
1934.....	8.428	3.860	4.158	52.191	47.973
1935.....	8.649	4.065	4.328	50.420	64.273
1936.....	9.474	4.710	4.901	46.441	45.087
1837.....	13.167	6.009	6.519	54.337	44.883
1938.....	10.000	4.739	4.610	42.301	43.225
1939.....	10.965	5.053	5.110	50.323	39.082
1940.....	11.296	5.179	6.335	49.827	34.773
1941.....	11.797	5.793	7.474	52.018	34.783
1942.....	11.775	6.481	8.250	52.000	38.333
1943.....	11.775	6.500	8.250	52.000	44.750
1944.....	11.775	6.500	8.250	52.000	44.750
1945.....	11.775	6.500	8.250	52.000	51.928
1946.....	13.820	8.109	8.276	54.544	80.151
1947.....	20.958	14.673	10.500	77.949	71.820
1948.....	22.038	18.043	13.589	99.250	74.361
1949.....	19.202	15.364	12.144	99.336	71.930
1950.....	21.235	13.296	13.866	95.539	74.169

(a) Lake copper 1897-98; domestic market since 1932. (b) New York since 1898-1902. (c) 99 percent tin 1897 to 1920, inclusive; Straits quality thereafter. (d) Average for eleven months. (e) New York Official. All quotations in cents per pound, except for silver, which are in cents per troy ounce.

E & M J Weekly Average Metal Prices — 1950

	Copper Domestic Refinery	Copper Export Refinery	Lead N. Y., Common	Zinc E. St. Louis, Prime Western	Tin N. Y., "Straits"	Silver N. Y., Foreign
Jan. 4..	18.200	18.425	12.000	9.780	77.500	73.250
Jan. 11..	18.200	18.404	12.000	9.779	77.250	73.250
Jan. 18..	18.200	18.425	12.000	9.764	76.375	73.250
Jan. 25..	18.200	18.425	12.000	9.752	75.333	73.250
Feb. 1..	18.200	18.425	12.000	9.750	74.542	73.250
Feb. 8..	18.200	18.425	12.000	9.750	74.417	73.250
Feb. 15..	18.200	18.425	12.000	9.750	74.450	73.250
Feb. 22..	18.200	18.425	12.000	9.750	74.425	73.250
Mar. 1..	18.200	18.425	12.000	9.750	74.167	73.250
Mar. 8..	18.200	18.425	12.000	9.750	74.500	73.250
Mar. 15..	18.200	18.425	10.833	9.821	75.042	73.250
Mar. 22..	18.200	18.425	10.500	10.000	76.625	73.250
Mar. 29..	18.200	18.425	10.500	10.117	77.042	73.150
Apr. 5..	18.200	18.425	10.500	10.350	74.875	71.750
Apr. 12..	18.200	18.425	10.500	10.500	76.125	71.750
Apr. 19..	18.560	18.592	10.500	10.538	76.896	71.750
Apr. 26..	19.200	19.425	10.792	10.963	77.167	71.750
May 3..	19.200	19.425	11.000	11.117	76.792	71.750
May 10..	19.200	19.425	11.292	11.600	76.917	72.750
May 17..	19.200	19.454	12.000	12.000	77.479	72.750
May 24..	20.200	20.425	12.000	12.083	77.958	72.750
May 31..	20.200	20.425	12.000	12.700	78.100	72.750
June 7..	21.300	21.092	12.000	13.750	78.125	72.750
June 14..	22.200	22.425	12.000	14.721	78.063	72.750
June 21..	22.200	22.425	12.000	15.000	77.063	72.750
June 28..	22.200	22.425	11.500	15.000	77.250	72.750
July 5..	22.200	22.425	11.000	15.000	78.925	72.750
July 12..	22.200	22.425	11.083	15.000	82.938	72.750
July 19..	22.200	22.425	12.000	15.000	93.000	72.750
July 26..	22.200	22.425	12.000	15.000	94.417	72.750
Aug. 2..	22.200	22.425	12.000	15.000	96.417	72.750
Aug. 9..	22.200	22.425	12.000	15.000	99.000	72.750
Aug. 16..	22.200	22.425	12.333	15.000	105.583	72.750
Aug. 23..	22.230	22.425	13.500	15.000	103.583	72.750
Aug. 30..	22.221	22.425	14.000	15.233	102.708	72.750
Sept. 6..	23.488	24.425	14.800	15.000	97.300	72.750
Sept. 13..	22.910	24.425	15.833	17.500	100.125	72.750
Sept. 20..	22.805	23.879	16.000	17.500	102.250	72.750
Sept. 27..	22.710	24.425	16.000	17.500	103.583	72.750
Oct. 4..	23.625	24.425	16.000	17.500	104.000	72.750
Oct. 11..	24.200	24.425	16.000	17.500	108.958	72.750
Oct. 18..	24.200	24.425	16.000	17.500	112.000	72.750
Oct. 25..	24.200	24.425	16.000	17.500	115.542	76.650
Nov. 1..	24.200	24.425	16.333	17.500	123.167	80.000
Nov. 8..	24.200	24.425	17.000	17.500	142.000	80.000
Nov. 15..	24.200	24.425	17.000	17.500	135.900	80.000
Nov. 22..	24.200	24.425	17.000	17.500	135.833	80.000
Nov. 29..	24.200	24.425	17.000	17.500	136.900	80.000
Dec. 6..	24.200	24.425	17.000	17.500	138.750	80.000
Dec. 13..	24.200	24.425	17.000	17.500	140.083	80.000
Dec. 20..	24.200	24.425	17.000	17.500	148.333	80.000
Dec. 27..	24.200	24.425	17.000	17.500	149.700	80.000

States absorbed around 70,000 tons. The consumption statistics of recent years, along with an estimate for 1950, excluding stockpiling, in tons:

TIN CONSUMPTION[a]

	World	U. S.
1935-39 (average)	157,000	62,347
1947	131,200	59,166
1948	135,700	59,863
1949	119,200	47,500
1950[b]	142,000	70,000

[a]Tin Study Group. [b]Estimated.

The British have been critical of our stockpiling operations in tin and maintained that much of the confusion in the market could be traced to bulk buying for the strategic reserve. In a recent issue of "Tin," published in London, it was admitted that the causes of the pressure on tin are many, but the publication declared that "it is the attitude of the United States Government that must be held responsible for much of the disorderliness of the market."

Control Plan Fails

Failure of the United Nations conference to agree on an international plan to control production and stabilize prices was attributed generally to the unyielding position taken by the United States. Points of disagreement over the plan involved the establishment of maximum and minimum prices, fixing of import and export quotas, and the introduction of a stockpile option clause that would, in effect, make available substantial tonnages from the buffer stock. The United States asked that the stockpile clause be added to permit any member country to obtain metal from the reserve. It also stipulated that a reduction in exports should not take place until the buffer stock contains at least 30,000 tons of tin. This was unacceptable to producers. Sir Hilton Poynton, of the British Colonial delegation, remarked that this clause was like "introducing a joker in a pack of cards."

The conference, that ended in Geneva on Nov. 21, took as its basis for discussion the draft agreement prepared by the Tin Study Group in Paris in March. A resolution was adopted adjourning until such time as conditions are favorable.

Legislation was passed extending the period of Government operation of the Texas City tin smelter for five years to June 30, 1956. Ore purchase contracts were concluded with Bolivia, Indonesia and the Belgian Congo. The Bolivian producers and the Reconstruction Finance Corp. extended the 1950 contract late in December for two months to provide additional time for drawing up a new agreement for 1951. Bolivian producers believe that more favorable terms will result in a higher output, possibly to 35,000 tons a year. A favorable development in Bolivia during 1950 was the decision of the authorities to permit mining companies to retain 40% of all foreign exchange resulting from the sale of concentrates.

The outlook for tin is so uncertain that no one in his senses would predict what is in store for either the producer or the consumer. That our Government takes a dark view of the situation is apparent in the restrictions on use announced in December. Consumption for January was fixed at 100% of the base period, and for February and March at 80%. The base, the average monthly use in the first half of 1950, was a period of reduced consumption of about 5,600 tons a month. Inventories of pig tin may not exceed 120 days for tinplate and 60 days on other tin-bearing products.

Political developments in the Far East will determine the course of the market. Complete allocation and price control of tin is likely in the near future.

Longhorn Tin Production

Production of pig tin from concentrates at the Longhorn (Texas City) smelter during 1949 and 1950, by months, in long tons:

	1949	1950
January	3,257	2,627
February	3,254	2,362
March	3,104	2,729
April	2,851	2,484
May	3,007	2,852
June	3,006	2,204
July	2,910	2,256
August	3,005	2,396
September	2,910	2,805
October	2,964	3,209
November	2,994	3,207
December	2,791	3,005
Total	36,053	32,136

Light Metals

» Plans call for a 55% increase in primary aluminum plant capacity and 400% increase in primary magnesium plant capacity.

RICHARD J. LUND, Supervisor Engineering Economics Div., Battelle Memorial Institute, Columbus, Ohio

BOTH ALUMINUM AND MAGNESIUM forged ahead to new post-World War II production records in 1950. Despite this, demand was so strong that industrial needs could not be completely filled. Because of the war in Korea, producers of primary metal invoked voluntary allocations in July to provide an equitable distribution of metal for civilian uses. These were supplemented late in the year by governmental inventory controls and defense order ratings, and, for aluminum, by restrictions on civilian use starting in December.

Plans to boost primary capacity were announced late in the year—about a 55% increase for aluminum and a 400% increase for magnesium. These capacity boosts involved reactivation of all the remaining usable Government standby facilities, plus substantial capacities for aluminum in new facilities to be constructed.

Aluminum

THE KOREAN WAR and accelerated mobilization program plus booming civilian demands resulted in production of an estimated 715,000 short tons of primary aluminum in 1950. This was about 18% ahead of the 1949 output and was exceeded by only the peak World War II

years of 1943 and 1944. Absence of major labor disputes plus a good water year contributed to this fine record. The July output was the highest monthly tonnage reached since July, 1944.

Supplementing the primary output was secondary production from scrap estimated at 250,000 short tons, comprising some 150,000 tons of recoverable aluminum alloy content of scrap produced by secondary smelters plus an estimated 100,000 tons of new and old scrap used by reduction plants and aluminum rolling mills in making various mill products. This represented a gain of 38% over 1949. Contributing to the higher secondary output were larger scrap imports, estimated at 65,000 tons in 1950, compared with 40,000 tons in 1949.

Imports of metal and semi-manufactures in 1950 are estimated at about 190,000 tons—more than double the 1949 shipments.

Total supplies of primary, secondary, and imports were thus about 1,155,000 tons, an increase of 285,000 tons over the total 1949 supplies.

Product shipments in 1950 were about 1,040,000 tons, comprising an estimated 820,000 tons of wrought products and 210,000 tons of castings.

The high rate of primary output was maintained by keeping bauxite production and imports at high levels—an estimated total of 3,800,000 long tons based on the record for the first nine months of the year. Imports accounted for about two-thirds of the total, and domestic production for about one-third.

Korean War Sparks Capacity Boosts

Shortly after the outbreak of the Korean War, the Government took steps to boost aluminum output through sale of equipment from the idle Government-held aluminum plants at Riverbank, Calif., and Burlington, N. J. Two pot lines and one line of rectifiers were sold to Kaiser; one pot line and one line of rectifiers to Reynolds; one pot line and one line of rectifiers to Apex Smelting Co., and one line of rectifiers to Harvey Machine Co. The entire sale was reported to total $2,300,000. A condition of the sale, completed in mid-August, was that the equipment must be in production within a year. Total capacity involved in this boost was about 100,000 tons annually.

Later in the year it was reported that Government defense officials had asked the industry to consider plans for expanding capacity by 2 billion pounds per year, compared with the then current operable capacity of about 1.4 billion pounds. This was later scaled down to 1 billion pounds, and then to 640 million pounds as a more practicable, immediate objective. A complete plan, agreed upon by industry, to attain the 640-million-pound goal was announced late in November.

At the same time, Alcoa announced a "quick action" plan to reactivate idle facilities at its Massena and Badin plants to produce 79,000 tons yearly by the use of high-cost power that would be uneconomic to use during normal times. The high-cost aluminum from these operations will be sold to the Government stockpile. Partial operations were started immediately, and the first ingot was delivered to the Government early in December. All of this temporarily reactivated capacity will be in production in 1951.

320,000-Ton Increase

The permanent 640 million-pound increase (320,000 tons) was shared as follows: (1) Reynolds, 100,000 tons, comprising another pot line (25,000 tons) at their Jones Mills plant (the line purchased in the summer from the Government) and the balance of 75,000 tons to be installed in a new plant to be powered by natural gas or coal; (2) Kaiser, 100,000 tons, comprising another pot line at their Mead plant and the balance of 80,000 tons to be installed in a new plant to be powered by natural gas or coal (apparently the two lines purchased from the Government in the summer are considered a part of this 100,000-ton increase); and (3) Alcoa, 120,000 tons, comprising two new pot lines (35,000 tons) at their Point Comfort plant, and the balance of 85,000 tons to be installed in a new plant to be powered by natural gas or coal. It was announced shortly thereafter that the terms of the contracts with the Government will obligate Reynolds, Kaiser, and Alcoa to sell in the open market to users of aluminum having no primary producing facilities of their own up to two-thirds of the output of these new facilities for a period of five years. For fifteen years thereafter, they must sell one-fourth of the output from these facilities to such non-producing users of the metal. It is estimated that during 1951 our capacity to produce primary metal will increase from the present figure of about 720,000 tons to about 915,000 tons, and that in 1952 it will be boosted to a figure of about 1,170,000 tons—well ahead of the peak World War II capacity of 1,132,000 tons.

Controls to Augment Stockpile

Voluntary allocations to civilian users were instituted in mid-summer by primary producers in order to prevent scare buying, hoarding, and to assure equitable distribution. Late in October NPA issued Order M-5, which set a ceiling on the amount of defense orders that must be accepted by aluminum producers, fabricators, and distributors in any month. Such ceilings on various products range roughly from 15 to 40% of average monthly shipments in the first 8 months of 1950.

On Nov. 13 the NPA issued Order M-7, which restricts nondefense use of aluminum beginning Jan. 1, 1951, to an amount each quarter to 65% of the average quarterly use during the January-June, 1950, base period. Usage in December was restricted to 100% of the average monthly consumption in the base period. Restrictions on December consumption were adjusted late in November, and early in December an amendment relaxed restrictions on usage during the first two months of 1951. January usage was permitted at 80% of the base period, and February at 75%. For March and thereafter, by quarters, the restriction is to be 65% of the base period.

It was over a year ago—late in 1949—when the Munitions Board added aluminum metal to the list of critical and strategic materials to be stockpiled. Just what the stockpile target amounts to is classified information, but The Conference Board reported[1] the goal for the first half of 1951 to be 100,000 tons of pig and ingot, a little below 15% of current output. It seems reasonably certain that cutbacks in nondefense uses in 1951 will channel at least this quantity into the stockpile in a 6-month period. Stockpile purchase goals for the last half of 1951 were reported by the same source at 50,000 tons—reflecting heavier defense usage later in the year.

In contrast with the skyrocketing price rises in virtually all basic commodities, the minor rise in the price of primary aluminum ingot

(*Continued on page* 94)

[1]The Conference Board Business Record, December, 1950, p. 454.

Minor Metals

»Hostilities spur uptrend in output, consumption, imports and price for most of the group. Mercury and arsenic are exceptions, with production of former down, use of latter off.

CHARLES WHITE MERRILL, Chief, Metal Ecomonics Branch, Bureau of Mines

A GENERAL UPTREND, accelerating after hostilities began in Korea, was evidenced by production, consumption, imports, and price for most of the minor metals. Only mercury was produced at a substantially lower rate in 1950 than in 1949. Consumption records where available showed a marked increase in 1950 compared with 1949, except for arsenic where the DDT type of insecticides continued to invade markets formerly demanding arsenicals.

Imports were larger for most of the minor metals, although the all-time record receipts of mercury in 1949 were not nearly equaled in 1950 and ilmenite imports declined substantially. The price trends for the minor metals were almost entirely upward, although some of the movements exhibited temporary reversals, particularly during the earlier months of the year. A major factor in the supply and price situation for a number of the minor metals was the demand of the Government's strategic stockpile program.

Cobalt

HUBERT W. DAVIS, Commodity Specialist, Bureau of Mines

CONSUMPTION OF COBALT made an all-time record in 1950, chiefly because of greater usage in permanent-magnet and high-temperature alloys, alloy hard-facing rods and materials, and ground-coat frit for porcelain enamel. Although the new supply of cobalt rondelles and granules in the first 9 months of 1950 was 21% greater than in the corresponding period of 1949, it was inadequate for industry and for stockpile commitments. The deficit was met by withdrawals from suppliers' stocks, which dropped from 1,667,000 lb. on Jan. 1, 1950, to 210,800 lb. on Sept. 30. The new supply of oxide made available was 58% larger, but it also was insufficient to meet industry demand, and suppliers' stocks declined from 234,000 lb. (gross weight) to 9,400 lb. So great was the demand for cobalt that voluntary rationing was initiated by suppliers in the third quarter of 1950. On Nov. 21, the National Production Authority issued a temporary directive limiting the civilian use of cobalt metal during the rest of November to 30% of the average monthly quantity used by the buyer in the first half year. In December civilian use was increased to 50%.

During the first 9 months, production of cobalt rondelles and granules in the United States was 1,198,200 lb., a decrease of 4% from the corresponding period of 1949, and imports (from Belgium and Belgian Congo) were 4,697,966 lb., a gain of 29%. Sales were up 73%. Production and imports of oxide (gross weight) were 335,143 and 629,999 lb., respectively, a loss of 16% in output but a gain of 200% in imports. Belgium supplied 614,250 lb. of the oxide, United Kingdom 15,680 lb. and Canada 69 lb. Sales of oxide were up 92%.

Consumption of cobalt by industrial consumers was 5,448,500 lb. in the first 9 months, compared with 3,513,300 in the corresponding period of 1949. Taking 38% of the 1950 total, magnet alloys represented the largest single use for cobalt, and the quantity used was 160% greater than in 1949. Cast cobalt-chromium - tungsten - molybdenum alloys took 24%, and usage was 26% more. More cobalt was used in alloy hard-facing rods and materials and in ground coat for porcelain enamel than in the corresponding period of 1949, and cobalt salts and driers were utilized at a rate about 34% greater. These gains were partly offset by declines of 29% and 13%, respectively, in use for high-speed steel and cemented carbides.

Bethlehem Steel Co., which recovers cobalt as a by-product concentrate from its Cornwall iron-ore mine in Pennsylvania, was again the only producer of commercial cobalt as ore in the United States. Output was 613,456 lb. (cobalt content) in the first 9 months, a gain of 38% over the corresponding period of 1949. Calera Mining Co. is building a concentrator and refinery to serve its Blackbird mine in Idaho. It plans to produce cobalt metal at a rate of 3,300,000 lb. annually.

Cobalt production in Belgian Congo, the largest producing country, was at the maximum rate in 1950. An electrolytic plant for extracting cobalt from a flotation concentrate made by Rhokana Corp., now building at Nkana, Northern Rhodesia, is to be completed in mid-1951. The ECA contracted for 7,200 tons of French Moroccan cobalt ore, which will be refined to metal at Deloro, Ont.

The cobalt content of white alloy imported from Belgian Congo during the first 9 months was 1,314,131 lb., a loss of 11% from the corresponding period of 1949, but receipts of ore from Canada were 13,270 lb., a gain of 13%.

During the first 9 months, consumption of cobalt contained in white alloy and ore by refiners and processors was 1,862,900 lb., a decrease of 6% from the corresponding period of 1949, but use of cobalt intermediates by refiners and processors was 791,500 lb., up 62%.

Reported exports during the first 9 months were 61,956 lb. (gross weight) of metal, including scrap. Exports of oxide, salts, and driers are not recorded separately.

Prices of cobalt metal and oxide were unchanged. Cobalt metal (97-99%, in kegs of 550 lb.) was $1.80 a pound delivered east of Chicago; metallurgical-grade oxide was $1.95 a pound of contained cobalt, f.o.b. Niagara Falls, N. Y.; and ceramic-grade oxide was $1.38 a pound (gross weight) east of the Mississippi River.

Antimony

ARNOLD S. KEMP, Commodity Specialist, Bureau of Mines

THE 1950 SUPPLY of primary antimony from all sources will be about 15,000 short tons, which is about the average annual consumption for 1946-1949.

Bradley Mining Co.'s Yellow Pine mine, Stibnite, Idaho, continued as the principal producer of domestic ore. The electric smelter operated below capacity, but most of the metallurgical problems have been eliminated.

Imports of antimony in ore were less than 10,000 short tons, compared to 7,473 tons in 1949. Imports of metal and regulus will provide another 3,500 tons for 1950, almost double that of 1949. As the result of China's withdrawal from the Geneva Agreement, the 1c. import duty on metal and regulus was increased 1c. to 2c. per pound, effective Dec. 11, 1950.

Recovery of secondary antimony will approximate 17,000 short tons, a decrease from 1949. Production of antimony in antimonial lead, from both domestic and foreign ores, at primary lead refineries will exceed the 1,610 tons reported in 1949.

The smelter at El Segundo, Calif., was dismantled, part of its equipment going to the Yellow Pine property in Idaho. The Laredo smelter shut down in October but was accumulating ore to resume in 1951. The Kellogg, Idaho, smelter was shut down early in the year.

The price per pound of antimony, bulk in carloads, Laredo, which had been 32c. since Oct. 7, 1949, declined to 28.75c. Jan. 13 and to 24.50c. March 2. On Aug. 31 the price was 28.50c. and before the end of the year it was again 32c., rising to that quotation Sept. 11, 1950. The New York equivalent of 32c. at Laredo is 33.78c. However, the metal grew scarcer, and before the year end the quotation was nominal occasionally, with no offer available. Imported Belgian, English, and Yugoslavian metal was being offered in New York at 36c. to 37.50c. per pound. The price was expected to continue upward after the posting of the 1c. per pound tariff increase on Dec. 11, 1950. Antimony ore prices rose over 100% from the year's low. In December, 50-55% grade was quoted $4.25 @ $4.30 per unit of antimony.

Military requirements for antimony oxide in various flameproofing uses have had some effect on the available supply of antimony. This will distort the normal demand-supply relationship.

Bismuth

ARNOLD S. KEMP, Commodity Specialist, Bureau of Mines

DOMESTIC PRODUCTION OF BISMUTH should be greater in 1950 than in 1949 because of increased smelting of the ores of major metals carrying bismuth as an impurity. Based on data for the first 10 months, imports will be materially greater than in 1949. Of 697,596 lb. imported through October, 57% was from Peru and 30% from Canada. Imports during 10 months in 1949 were 412,972 lb., the full year totaling 541,852 lb. Imports of bismuth in 1948 were only 299,824 lb. The 10 month imports from Canada indicated that that country might rival Peru as a source of United States supply. Almost the entire output in Mexico is imported as bismuth-lead bullion for refining in the United States and is considered domestic production. Exports of bismuth metal and alloys, principally to the United Kingdom, in the first 10 months were 151,220 lb., slightly more than the comparable figure for 1949.

The New York market price of metallic bismuth remained at $2 per pound until Sept. 5, 1950, when it was advanced to $2.25. The $2 per pound, in ton lots, quotation had prevailed since Feb. 20, 1947, when it was increased from $1.80.

Cadmium

RICHARD H. MOTE, Commodity Specialist, Bureau of Mines

OUTPUT OF CADMIUM METAL in the United States in 1950 rose about 10% to an estimated 8,860,000 lb., the highest level in the history of domestic production. Most of it came from primary sources, but a small quantity of secondary metal came from old bearings and other alloy scrap.

Detailed statistics on consumption are unavailable. Sales data indicate that the established use pattern remained virtually unchanged.

Total imports for consumption of metallic cadmium and cadmium contained in flue dust increased an estimated 6% in 1950. Imports of cadmium-bearing flue dust, all from Mexico, dropped slightly more than 16% from the 1949 rate. Metallic cadmium imports, however, were more than twice the total imported in 1949 and the largest quantity recorded since 1937. Canada supplied over 45% of the metal imported in 1950, Japan 31%, Mexico nearly 19%, Belgium-Luxembourg, 2%, Netherlands over 1%, Peru and Egypt the balance.

ECA countries continued to receive substantial quantities of metallic cadmium from the United States in 1950, despite an estimated decline of 40% in exports.

The quoted New York price of $2 per pound for commercial sticks of cadmium, established Nov. 15, 1948, continued through June 14, 1950. Effective June 15, the quotation advanced to $2.15 a pound. On the same day the price for patented shapes was raised from $2.15 to $2.30 a pound. On Sept. 15 the quotation for commercial sticks advanced to $2.40 a pound and for patented shapes to $2.65. A further rise to $2.55 for commercial stocks occurred Dec. 1.

Arsenic

ARNOLD S. KEMP, Commodity Specialist, Bureau of Mines

DOMESTIC ARSENIC PRODUCTION is directly related to the volume of copper and lead ores smelted. On the basis of figures for 10 months it is estimated that the total domestic production of crude and refined arsenic will equal or exceed the 12,795 tons reported in 1949.

Imports of arsenic, mostly as arsenic trioxide, for 10 months were over 11,000 tons compared to 4,696 tons in the entire year 1949. Of this 83% of the trioxide came from Mexico. Imports from the United Kingdom and Netherlands accounted for about 88% of the small quantity received as metallic arsenic.

Apparent consumption of white arsenic in 1950 will be less than in 1949, as a result of the trend toward greater use of organic insecticides.

The quoted price of 5½c. per pound, in barrels, carload lots, which had prevailed since Oct. 1, 1949, was increased to 6c. on Sept. 25, 1950. Price advanced to 6¼c., effective Dec. 5, 1950.

Beryllium

JACK W. CLARK, Commodity Specialist, Bureau of Mines

INCOMPLETE RETURNS indicated that domestic mine production of beryl would closely approximate the all-time high of 475 tons reached in 1949. Arthur Montgomery's Harding mine, near Dixon, N. Mex., was the largest individual producer in 1950, its output being enough to put New Mexico ahead of all other states. Significant quantities of ore continued to come from South Dakota, Colorado, and New England.

United States imports of beryl during the first 11 months totaled nearly 3,700 tons, indicating that a full year's receipts should at least equal the 1949 total intake of 3,811 tons. Sudden emergence of Southern Rhodesia as a possible major beryl producer and the greatly expanded output from the Union of South Africa were salient features in the foreign scene. In Brazil, principal world source of beryl, there was increased agitation for imposition of a beryl export embargo.

With defense orders for beryllium copper mounting rapidly after the Korean conflict started, it seemed probable that 1950 domestic consumption of beryl would appreciably exceed the abnormally low consumption in 1949.

Prices quoted nominally in *E&MJ Metal and Mineral Markets* during 1950 for beryl ore per short ton unit BeO, 10-12% BeO minimum, were as follows: domestic, f.o.b. mine, Jan. 5, $25-$35; Oct. 12, $26-$30. Imported, c.i.f. United States ports, Jan. 5, $26-$30; April 27, $26-$28; unchanged thereafter. Until July 14 beryllium copper master alloy (4% Be) was quoted at $24.50 per lb. contained Be (plus the price of copper at market), increasing thereafter to $30. In mid-November an additional increase was posted, raising the quotation to $1.56 per pound of alloy; at the same time the previous pricing method based upon beryllium content was suspended.

Mercury

HELENA M. MEYER, Commodity Specialist, Bureau of Mines

THE MERCURY INDUSTRY was again featured by receipts from abroad in excess of consumption needs. In 1949, however, a large part of the imports had gone to the Government stockpile, but the large 1950 entries were not so destined. The situation also was characterized in 1950 by continued small domestic output and by a sudden reversal after midyear of the longtime downtrend in prices. Production was at the lowest level in the 100 years since 1850 covered by the domestic record. The beginning of the uptrend in prices coincided with the outbreak of the Korean war.

Domestic production was dominated by the Mount Jackson (including Great Eastern) mine, Sonoma County, Calif. The other most important producer was the Cordero, Humboldt County, Nev., which, however, was in operation to Feb. 15 only.

In the first 10 months, 54,064 flasks were received from abroad (general imports) compared with 92,929 in the same period of 1949. In 1949 imports were 36% higher than the previous record in 1945; the 1950 total will rank in size next to these record years. Italy supplied 87% of the 1949 total, but Spain ranked first in 1950 with 53%; Italy was the source of 30% in 1950, Yugoslavia 8%, and Mexico and Japan 6 and 2%, respectively.

Exports and re-exports together approximated only 2% of imports in 1950.

Consumption of mercury, if use in the fourth quarter held at levels prevailing in the first three, gained about 15% over 1949, despite the fact that there were no spectacular uses in 1950 such as that for the mercury boiler and chlorine and caustic soda plant installations of 1949 and 1948, respectively.

Data covering 9 months indicate that the electrical use of mercury, including the mercury cell, gained sharply over 1949. Most of the military batteries now produced are for use in air-sea transceivers, and hearing aids also continue an important outlet for the mercury batteries. Antifouling paint consumption more than doubled in 1950, and such important fields as pharmaceuticals and dental preparations took much larger quantities than in 1949. Antifouling paint increases followed a noteworthy rise in 1949. Consumption for agricultural purposes dropped in 1949 after earlier gains and in 1950 was stabilized at the 1949 level.

Prices continued to drop in the first half, and the quotation for June was at the lowest monthly level since September, 1935, despite the doubling of the BLS wholesale price index in the period. By early December the quotation was 74% above June and seemed headed higher. The low level of domestic production, the concentration of output outside the United States in a few areas, and the prospects that consumption would increase because of the stepped-up defense program combined to pave the way for the sharp price gains.

According to data for a large part of the year Spain and Italy continued to produce far below their production potential, owing to curtailed world markets. Expanded exports from Spain caused a sharp reduction in metal available for sale at the end of the year. Italy's exports evidently were much below Spain's, in contrast to the 1949 situation. Imports into the United Kingdom, second largest world consumer in the first 8 months, were 38,348 flasks compared with 4,939 flasks during the same period of 1949. Allowing for re-exports, net imports were 30,578 and 3,447 flasks respectively.

Platinum-Group Metals

HUBERT W. DAVIS, Commodity Specialist, Bureau of Mines

CONSPICIOUSLY GREATER DEMAND which reversed a four-year downward trend, inadequate supplies, higher price, and some speculative trading were features of the plati-

num industry in 1950. The quoted price ranged from $69 to $103 an ounce. The $103 quotation which prevailed from Sept. 11 to Oct. 18 was the highest since March, 1927. The sharp upturn caused the leading refiners to adopt voluntary rationing. Noteworthy was the receipt of 58,188 oz. of platinum from the United Kingdom in the first 9 months, of which 34,000 oz. was for the Government stockpile. Demand for palladium was substantially greater and well above imports and domestic refining, but the price remained static at $24 an ounce. A feature of the import statistics for palladium was the receipt of 44,427 oz. from U.S.S.R., the first since October, 1948. Demand for iridium, osmium, rhodium, and ruthenium was likewise much larger and exceeded the new supply. The quotation for iridium ranged from $100-$105 to $220 an ounce, osmium from $100 to $200, and ruthenium from $69 to $103. The price of rhodium was unchanged at $125.

Domestic refining of platinum in the first 9 months was at about the same rate as in the corresponding period of 1949 but equal to only one-fourth of the demand, which nearly doubled. Recovery by domestic refiners was supplemented by imports, chiefly from Canada and United Kingdom, but the quantity was inadequate to meet needs, and withdrawals from stocks of refiners and dealers were necessary. The jewelry industry was again the largest customer. Total sales to domestic consumers (230,000 oz.) in the first 9 months were 104% more than in the corresponding period of 1949. Imports of refined platinum were 154,728 oz. and export sales 15,151 oz. during the 9 months.

Refining of palladium in the United States during the first 9 months was 40% lower than in the corresponding period of 1949 and was inadequate for the much greater demand. The deficiency was met by imports of 91,520 oz., chiefly from Canada and U.S.S.R., and partly by withdrawals from stocks of refiners and dealers. The electrical industry was the largest buyer. Total domestic and export sales were 127,400 oz. in the 9 months, a gain of 26% over the corresponding period of 1949.

Refining, imports, and sales of the other platinum-group metals—iridium, osmium, rhodium and ruthenium—were comparatively small. Refining of each metal was at a lower rate than in 1949, but imports were larger. Sales of iridium, osmium, rhodium, and ruthenium in the first 9 months were 45, 62, 113, and 93%, respectively, greater than in the same period in 1949.

Titanium

FRANK J. CSERVENYAK, Metallurgist, Bureau of Mines

TITANIUM METAL was produced commercially for the third successive year. While accurate figures are not available, it is estimated that more than 200,000 lb. of titanium sponge was made in 1950. Commercial-purity titanium metal (approximately 99.5%) in limited quantities was offered in a wide range of fabricated products such as large sheets, strips, plate, bar, forgings, tubing, and wire. Ingots of titanium weighing 500 lb. were produced, and production of 1000-lb. ingots was reported. Producers were unable to meet the heavy demands for strategic and experimental applications.

Titanium was produced commercially in 1950, using modifications of the Kroll process, by E. I. duPont de Nemours and the National Lead Co. The Bureau of Mines continued operation of its titanium pilot plant.

Important developments included the formation of new titanium organizations. Rem-Cru Titanium, Inc., jointly owned by Remington Arms Co. and Crucible Steel Co. of America, was formed to make titanium and titanium-alloy products. National Lead Co. and Allegheny Ludlum Steel Corp. organized Titanium Metals Corporation of America to market and distribute titanium metal, its alloys and various related products. Sharon Steel also announced that it was joining the ranks of steel companies going into the titanium-sheet business.

In Canada, Dominion Magnesium is producing titanium powder and pellets for use in high-temperature alloy and stainless steel at its pilot plant at Haley, Ont. Although titanium with a purity of 98.5 to 99% plus is obtainable, consistent production of titanium metal having acceptable ductility cannot yet be reported.

Large-scale mining was begun in 1949 at the Allard Lake, Que., ilmenite property of Kennecott Copper and New Jersey Zinc. Smelting operations were begun at Sorrel on a test basis with one electric furnace on ore shipped late in 1950. Four additional electric furnaces are under construction. The smelter is designed to treat 1,500 tons of 30 to 50% TiO_2 ore daily, to produce 700 tons of 70% plus TiO_2 slag.

Titanium pigments production and shipments were higher than ever before, exceeding 1949 and the record established in 1948, by possibly one-third and one-quarter respectively. National Lead announced in midyear that it would begin immediately to expand its titanium-pigment production capacity. The total expansion was 60,000 to 70,000 tons annually.

The domestic mining industry was featured by new maximum production of ilmenite for the fourth successive year. Imports were substantially lower.

Domestic output of ilmenite in 1950 was 467,300 short tons containing 238,150 tons TiO_2. Production of ilmenite from the DuPont property in Starke, Fla., exceeded that in 1949. National Lead's Tahawus property continued the world's largest ilmenite producer. Shipments totaled 454,300 tons containing 231,250 tons TiO_2 and were 17% higher than in 1949.

Ilmenite Imports Down

Imports of ilmenite for January to October, inclusive, were 177,000 short tons, a decrease of 40% under the 295,000 tons received in the first 10 months of 1949. India again dominated the list of suppliers; however, imports from India for January to October dropped to 157,000 tons, a decrease of 43% under the 277,400 tons sent in the first 10 months of 1949.

Production of rutile in 1950 increased slightly over 1949, two companies producing it.

Imports of rutile, all from Australia, were 2,950 short tons in the first 10 months, an increase of only 200 tons over receipts in the same period of 1949.

Quotations covering ilmenite were unchanged. Quotations per gross ton for ilmenite containing 56 to 59% TiO_2, f.o.b. Atlantic seaboard, remained at $14-$16 during the first 10 months.

Nominal quotations for rutile, guaranteed minimum 94% concentrate, were 4-5c. a pound when the year began and dropped to 3½-4½c. in April, at which level they remained for the rest of the year.

Light Metals

(*Continued from page* 89)

during 1950 from 17 to 19c. per lb. was another factor contributing to the extraordinary demand for the metal.

On the other hand, secondary aluminum ingot followed the general pattern, with a rise during the year (mainly in the last 6 months following the Korean outbreak) of over 70% to 31c. per lb. at the year's end. Secondary metal was thus selling at a level 63% above that for primary metal. Prices for aluminum in the gray market, like those for many other scarce commodities, rose to fantastic levels.

Building Drops in Use Pattern

Substantial losses of percentage use of aluminum in building products were offset by slight gains in usage for transportation, power transmission, and household appliances. The 1949 and 1950 use patterns of the metal, as shown by shiments of ingot and mill products by the three producers of primary aluminum, weighted according to their output of primary metal, were as follows:

	Percent of Total	
	1950	1949
Building Products ...	23	27
Transportation	18	17
Power Transmission..	10	9
Household Appliances	7	6
Cooking Utensils	5	6
Machinery	5	4
To fabricators for processing, plus other uses	32	31
	100	100

The impact of military uses, felt only to a minor extent in 1950, will start to hit hard in 1951. Aircraft will take the major share in the defense program, but demands for its use in a thousand and one military and naval items for weight-saving and corrosion resistance will grow steadily.

Magnesium

OUTPUT OF PRIMARY MAGNESIUM in 1950 forged ahead of 1949 by an estimated 36%—15,750 short tons in 1950 were produced at Dow's Freeport plant compared with 11,598 tons in 1949. Based on the 9-month record, shipments of products were only 29% ahead of those in the same 1949 period. With the primary output being stepped up successively higher in each month of the last quarter, it is not unlikely that total product shipments for the full year 1950 were ahead of 1949 by nearly the same percentage as for primary metal output. Whereas in the first 9 months of 1949 wrought products comprised about 46% of total product shipments, in the same period of 1950 wrought products comprised 53% of the total. This increase in use of wrought products undoubtedly reflects the larger amounts going into the stepped-up aircraft program.

Primary ingot sold and used by producers for making magnesium alloys amounted to about 12,500 tons, and for making aluminum and other non-magnesium alloys to about 8,000 tons. Total consumption of primary metal thus amounted to about 20,500 tons in 1950—almost 5,000 tons higher than production. This represents net withdrawals from inventories.

Primary supplies were augmented by secondary output estimated at 6,000 tons, about 3,000 tons of which were used in magnesium alloys and an equal amount in aluminum and other non-magnesium alloys. Secondary output was at virtually the same level in 1949.

Grand total of primary and secondary magnesium consumption is thus estimated at 26,500 short tons in 1950.

Plan Five-Fold Boost in Output

Stepped-up defense requirements for magnesium were reflected in the Government plan to reactivate six standby magnesium plants, announced in mid-September. These plants are as follows:

Plant Location	Capacity, Short Tons
Painesville, Ohio (e)	18,000
Velasco, Texas (f)	36,000
Canaan, Conn. (f)	5,000
Manteca, Calif. (f).....	10,000
Wingdale, N. Y. (f).....	5,000
Spokane, Wash. (f).....	24,000
Total	98,000

(e) Electrolytic. (f) Ferrosilicon.

The relatively high-cost output of these plants will be sold to the Government for stockpiling.

Late in December it was announced that plans had been completed for reopening three of the plants early in 1951—the Painesville plant to be operated by Diamond Magnesium Corp., a subsidiary of Diamond Alkali Co., operator of the plant in World War II; the Canaan plant to be operated by Nelco Metals, Inc., a subsidiary of New England Lime Co., who operated the plant in World War II; and the Wingdale plants by mid-February.

Dow has added to the capacity of its wholly-owned Freeport plant to a present level of 24,000 tons, and started stepping up production shortly after the Korean outbreak. They expected to have the plant going at its full capacity of 2,000 tons monthly by the end of 1950.

122,000-Ton Output Planned

With the reactivation of all six Government plants and capacity operations at Freeport, primary magnesium output will be at the rate of 122,000 short tons annually—still far short of the record 184,000 tons attained in 1943.

Of great significance to the future of the industry was the plan announced by Dow in 1950 to construct a continuous rolling mill for magnesium at Madison, Ill. At the end of 1950, engineering plans for the plant were progressing and some equipment was on order, but no actual construction had been started. Plans call for completion of the plant in 1952. Planned for an ultimate capacity of 3 million pounds of sheet monthly, this facility should result in lowering substantially the spread between prices of ingot and sheet magnesium. It should go far toward further boosting the growth rate of this ultra light-weight metal. Present rolling capacity is a mere 400,000 lb. monthly. Rolling facilities were also augmented in 1950 by the establishment by Alcoa of a new division for rolling magnesium at its New Kensington works.

Price of primary magnesium ingots was raised 4c. per lb. during 1950—from 20.5c. to 24.5c. This was still only a modest 20% rise above the previous level that had been held steady for seven years.

Comprehensive reviews of the growth of the magnesium industry over the past decade, with forecasts of its future, were presented by Hanawalt[2] and Christiansen.[3]

[2]Hanawalt, J. D., A review of Productive Capacity in the Magnesium Industry, *Metal Progress*, Oct., 1950, pp. 512-518.

[3]Christiansen, Edw. S., Magnesium Looks Ahead, Address Presented to the sixth annual meeting of the Magnesium Association, New York City, Nov. 9, 1950.

Ferro-Alloy Metals

» **Defense requirements cause surge in demand. Lagging domestic production will receive Government help under Defense Production Act.**

ROBERT H. RIDGWAY, Chief, Ferrous Metals and Alloys Branch, Bureau of Mines

THE 1950 PRODUCTION of ferro-alloys is estimated at 2,000,000 short tons, a 30% increase over 1949 production of 1,544,000 tons, reflecting the increase of about 40% in alloy steel production.

Increasing demand for alloy steels throughout the year kept the production of ferro-alloys on an increasing trend from the already high point reached at the opening of 1950.

Imports of ores and alloys were high in general, as was domestic alloy production. Domestic output of some ores, notably manganese and chromite, did not respond to the general urging of the market owing to inability to expand existing operations and lack of economically sound reserves.

The needs for the ferro-alloying metals in defense production required a new evaluation of the importance of ferro-alloy supplies, with the result that various methods of obtaining greater domestic production, increasing imports and reducing consumption by limitation of nonessential uses and substitution of other materials were explored. Manganese, chrome, and nickel all were given particular attention as to the development of new domestic and foreign sources.

Prices of almost all alloy metals, alloys and the ores moved upward with the exception of chromite, which merely firmed up at the level attained at the end of 1949.

The Defense Production Act of 1950 (Public Law 774, 81st Congress, 2d Session) signed by the President Sept. 8, 1950, among other things, authorized the Government to aid producers of minerals through purchase contracts, loans and other means. The Defense Minerals Administration, headed by Dr. James Boyd, was set up in the Department of the Interior to implement this minerals program.

Chromite

NORWOOD B. MELCHER, Assistant Chief, Ferrous Metals and Alloys Branch

CHROMITE IMPORTS in 1950 continued to exceed consumption and, on the basis of the first 10 months figures, probably will exceed 1949 total. The excess of tonnage imported over that consumed was less than in 1949 due to a great increase in consumption during 1950. Consumption of all grades—metallurgical, refractory, and chemical—increased in 1950.

Of over a million tons of chromite imported during the first 10 months of the year, the Union of South Africa contributed 30%, mostly chemical grade, with some metallurgical; Turkey 19%, mostly metallurgical; the Philippines 16%, refractory and metallurgical; and Southern Rhodesia 14%, largely metallurgical; followed by Cuba 7% refractory grade, U. S. S. R. 6% metallurgical, and New Caledonia 5% metallurgical, the remaining 3% being divided between Canada, Guatemala, Pakistan and Yugoslavia.

Consumption of all grades of chromite throughout 1950 was high and increased from quarter to quarter. Total consumption for the year is estimated at 960,000 tons and may set a new record by topping the 1943 total of 964,600 tons. The usage of the different grades showed some change in pattern over 1949 and did not increase proportionally along with the over-all increase. The proportion of metallurgical grade increased from 43% in 1949 to 50% in 1950, refractory grade decreased from 40% to 36% and chemical grade decreased from 17% to 14%. This use distribution reflects the sharp increase in the use of ferrochrome (estimated to have been 150,000 tons), chrom-X and chromium metal in the course of the year.

Consumers' stocks of all grades of chromite showed a considerable drop from the total of 756,995 tons at the year-end 1949 and are estimated to have been less than 600,000 tons on Dec. 31, 1950.

Prices on chrome ore did not change to any great extent throughout the year. Quoted prices at the end of the year on 48% Cr_2O_3 ore, with a 3:1 chrome-iron ratio, ranged from $36 to $44 per long ton, f.o.b. cars Atlantic ports, dry. Variations in price on any one grade of ore are due to the differences in amounts of silica and alumina contained. Ore of 48% grade but no specified chrome-iron ratio held fairly steady at $27 per long ton.

Domestic production for 1950 is estimated to have been less than 700 tons, all from California. Reserves of domestic ore are inadequate to permit a large expansion of the domestic industry. However, a program is presently underway which may provide a considerable tonnage of chemical and metallurgical ore and some refractory material.

Manganese

NORWOOD B. MELCHER, Assistant Chief, Ferrous Metals and Alloys Branch, Bureau of Mines

IMPORTS OF manganese ore during the first 10 months of 1950 totaled over 1.5 million short tons of manganese ore. Probably the total for the year approximated 1.8 million tons, approached only by the 1946 total of 1.75 million tons.

This improvement in the ore import picture reflects the effect of Government efforts (in particular the Interdepartmental Manganese Coordination Committee) and industry to expand the imports of manganese. The success of the intensified drive is outstanding in

view of the continuance of the almost complete embargo on imports from the U. S. S. R., which supplied about 3% of the total for the year. Substantial increases in tonnages from Angola, Belgian Congo, Chile, Cuba, French Morocco, India and the Union of South Africa more than offset decreases from Brazil, Gold Coast, Mexico, the Philippines and the U. S. S. R.

Transportation a Problem

Transportation facilities in general remained a limiting factor in the supply system. The Union of South Africa increased its production in part through a program of supplying railroad cars. Port congestion and lack of sufficient rail facilities limited the amount of ore obtainable from the Gold Coast and from India.

In the early part of 1950 the Gold Coast shipping port of Takoradi was severely congested, as was the rail connection between the port and the mine area. The Gold Coast has no natural harbors, and the artificial seaport of Takoradi was put in operation in 1929. The Colonial Government plans to enlarge this harbor, which covers about 220 acres at present. The narrow-gage railroad, owned and operated by the Government, lacks sufficient rolling stock to handle the freight demand, and over a third of the present equipment is overage.

India is short of freight cars, and during 1950 large shipments of foodstuffs took preference over ore shipments. In the third quarter of the year considerable congestion developed at the port of Visagapatam, which cut imports during the period. Brazil was similarly handicapped by inadequate transportation facilities.

A breakdown on the basis of the first 9 months of 1950 shipments showed a ranking in approximate percentage of total imports to be: India 34%, Union of South Africa 27%, the Gold Coast 17%, Brazil 8%, Cuba 5%, U. S. S. R. 3%, and the remaining 6% divided among Angola, Belgian Congo, Chile, French Morocco, Greece, Mexico, the Philippines and Turkey.

Although domestic production of manganese held approximately steady with the levels of 1949, there was an over-all increase in mine shipments. About 97% of domestic production was from Montana, the remainder coming from Arizona, Arkansas and Tennessee. A change in the pattern of shipments from Montana was noted in that formerly the ore was routed through the Great Lakes and only moved during the summer months. Due to the installation of the furnaces at Black Eagle and Anaconda a larger part of the ore is being converted to ferromanganese before shipping. The metallurgical ore produced in Montana consisted of high-grade nodules from Anaconda Copper; all battery-grade ore was produced from the Phillipsburg district in Montana.

The Cuyuna range was the source of over 90% of the ferruginous manganese ore and manganiferous iron ore containing between 5 and 35% manganese, although relatively small shipments were made from Arkansas, Montana, Nevada and New Mexico.

Ferromanganese production rose sharply early in 1950 and maintained a fairly high rate and indicated an increase over 1949 to an estimated 720,000 short tons. Imports of the alloy increased considerably and if the rate established up to Sept. 30 continued until the end of the year, a new record was reached. Most of the imported ferromanganese came from Norway, France and Canada and was made largely from Gold Coast ore. Some smaller amounts of the alloy were imported from Belgium-Luxembourg, Chile, Germany, Japan and the United Kingdom. Consumption of ferromanganese exceeded domestic production and the deficiency was made up by imports and reductions in consumer stocks. Indications are that ferro stocks held by consumers were slightly lower at the end of 1950 than a year ago.

Consumption of manganese ore in the United States for 1950 is estimated at 1,600,000 short tons, which will exceed that of 1948 and 1949. If consumption of imported ferromanganese is evaluated in terms of ore and added to the above estimate it will exceed 1,800,000 tons.

Stocks Decrease

Consumer year-end stocks of ore showed a likelihood of being somewhat lower than the 928,000 tons on hand at the beginning of 1950. Stocks were expected to approximate 800,000 tons.

Prices of manganese ores continued to climb throughout the year, being quoted by year end at $0.88 to $0.92 per long-ton unit on the basis of 48% manganese c.i.f. U. S. ports, duty extra. Ferromanganese of 78-82% grade was priced at $185 per gross ton at seaboard. The duty of ¼c. per lb. of contained manganese continued throughout 1950.

Molybdenum

ROBERT W. GEEHAN, Commodity Specialist, Bureau of Mines

ALONG WITH MOST of the other ferro-alloy metals, molybdenum was reported to be in rather short supply at the end of 1950. Production rates increased in the last half year, but were unable to meet the increase in demand from industry, export, and the Government stockpile. Stocks of concentrates and products declined 13% and 31%, respectively, during the first three quarters of 1950. A program to further expand production at the Climax mine is underway. Utah was the largest molybdenum-producing state. Exports of molybdenum concentrates were 43% greater in the first 9 months than in the corresponding period of 1949.

By-Product Moly Leads

Domestic production of concentrates was 19,745,600 lb. (contained molybdenum) in the first 9 months. Producing states were Arizona, California, Colorado, Nevada, New Mexico and Utah. Arizona, Nevada and Utah increased production over that of a similar period in 1949. Production of concentrates at mines, operated solely or almost solely for molybdenum, was 7,274,900 lb. in the first 9 months, a decrease of 18%; by-product concentrates from copper and tungsten operations totaled 12,470,700 lb., an increase of 51%. By-product molybdenum represented 63% of the total concentrates produced in the first 9 months, compared with 48% in the corresponding period of 1949. Shipments of concentrates in the first 9 months comprised 18,577,500 lb. to domestic consumers and 4,097,800 lb. for export.

Consumption of concentrates was 17,621,000 lb. (contained molybdenum) in the first 9 months, an increase of 9%.

Production of concentrates in the first 9 months was less than usage and exports, and stocks held by industry declined to 16,704,000 lb. (contained molybdenum) on Sept.

30, 1950, from 19,159,000 on Dec. 31, 1949.

Production and shipments of molybdenum products totaled 17,245,300 and 20,642,000 lb. (contained molybdenum) in 9 months of 1950, gains of 8 and 70%, respectively. Stocks of products held by producers were 7,441,000 lb. (contained molybdenum) on Sept. 30, 1950, compared with 10,838,000 lb. on Dec. 31, 1949.

In December, 1950, the price of concentrates containing a minimum of 90% of MoS_2 was raised to 60c. a lb. of MoS_2. The former quotation of 54c. had been in effect since January, 1949.

Nickel

HUBERT W. DAVIS, Commodity Specialist, Bureau of Mines

A SUBSTANTIAL UPWARD SURGE in nickel requirements, exceeding production, resulted in an acute shortage in 1950 and voluntary rationing of the available supply. Beginning Jan. 1, 1951, non-military use of nickel was reduced 35%. Output of nickel in Canada during the first 9 months of 1950 was 7% less than in the corresponding period of 1949. However, receipts of nickel from Canada during the first 10 months were slightly larger than in the like period 1949, but imports from Norway and United Kingdom declined. Because of this shortage, some steel companies have reverted to the National Emergency steels of World War II, some automobile companies have reduced the thickness of plating, and foundries are producing leaner nickel alloys. To aid in alleviating the shortage, the Government-owned idle nickel facilities at Nicaro, Cuba, which have a capacity of 32,000,000 lb. of nickel as oxide, will be reactivated. Enlargement of the Kristiansand (Norway) refinery of Falconbridge Nickel Mines, Ltd., to produce 30,000,000 lb. of nickel annually is expected to be completed in the latter part of 1951.

Canadian Output Drops

Nickel production in Canada was 90,738 short tons during the first 9 months of 1950 compared with 97,341 tons during the corresponding period of 1949. Exports during those periods were 92,654 and 98,690 tons, respectively.

Imports in the first 10 months of 1950 (figures for full year 1949 are shown in parentheses) comprised 115,425,663 (144,680,899) lb. metal, 18,335,403 (22,256,644) lb. matte, and 30,505,822 (24,483,602) lb. oxide and oxite sinter. Canada was the chief source.

Exports consist largely of products made from imported raw materials. During the first 10 months of 1950 (figures for full year 1949 are shown in parentheses) they comprised 4,558,606 (5,568,949) lb. alloys and scrap, 619,254 (1,610,329) lb. metal, 357,728 (686,270) lb. nickel-chrome electric resistance wire, and 460,607 (1,024,613) lb. nickel silver.

Effective June 1, 1950, the contract price to United States buyers for electrolytic nickel in carlots f.o.b. Port Colborne, Ont., was advanced to 48c. a lb., including duty of 1¼c. a lb. The former price of 40c. a lb. had been in effect since July 22, 1948. On Dec. 13, 1950, the price was raised to 50½c. a lb.

Tungsten

ROBERT W. GEEHAN, Commodity Specialist, Bureau of Mines

BECAUSE OF THE SUDDEN INCREASE in demand for tungsten products during the last 4 months of the year and the decrease in imports from Asia, a shortage of tungsten concentrates has developed and the price has advanced to more than double that quoted for foreign concentrates at the first of the year. However, in the first 9 months of 1950, total tungsten concentrates consumed was 15% less than the corresponding period of 1949. Usage of concentrates was at a quarterly rate of 1,110 tons during the first half but increased to 1,720 tons in the third quarter and will undoubtedly be greater in the fourth quarter. Stimulated by increased demand from stockpile sales and from industry during the last half year, both domestic production and imports for consumption increased during 1950.

Production of domestic concentrates is expected to approximate 4,000 short tons (60% WO_3 basis) in 1950, a 31% increase from 1949. The increase resulted chiefly from resumption of operations by the Nevada-Massachusetts Co. and expanded operating schedules at most of the other producers. Climax Molybdenum Co. in Colorado, Nevada-Massachusetts Co. in Nevada, Tungsten Mining Corp. in North Carolina and U. S. Vanadium Corp. in California accounted for over 80% of concentrates produced in 1950.

Korea, Our Chief Source

General imports (receipts) of tungsten ores and concentrates into the United States were 6,363 short tons (60% WO_3 basis) during the first 9 months of 1950. (7,731 tons during the entire year 1949.) These quantities represent ores and concentrates received in the U. S. A., irrespective of final disposition; about 77% of total imports entered bonded warehouses. Korea (2,403 tons), Bolivia (820 tons), Siam (748 tons), Brazil (521 tons), Peru (505 tons), Australia (407 tons), and China (359 tons) supplied 91% of the total for the first 9 months of 1950.

Imports of ores and concentrates for consumption were 11,588 short tons (60% WO_3 basis) during the first 9 months of 1950 (6,592 tons during the entire year 1949). The quantities represent ores and concentrates on which the duty has been paid and concentrates received duty-free for U. S. Government account. In the first 9 months of 1950 no ores and concentrates were withdrawn from warehouses for smelting, refining, and export. (434 tons in the entire year 1949), and 289 tons (gross weight) were reexported (939 tons in 1949).

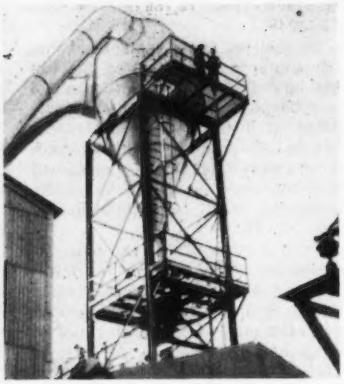
Exports of tungsten ores and concentrates in the first 9 months of 1950 were 364 lb. (gross weight).

Consumption of tungsten concentrates in the United States during the first 9 months of 1950 was 3,940 short tons (60% WO_3 basis) compared with 4,620 tons in the corresponding period of 1949.

Prices Treble in 1950

E&MJ quotations on imported ores and concentrates increased steadily from $17.50-$18 to $54-$56 a short ton unit of WO_3, duty paid, during the year. Domestic scheelite of good known analysis advanced from $28.50 a unit delivered to $47 a unit, f.o.b. mines. The duty on imported ore and concentrates increased from $6.03 to $7.93 in December, 1950.

SIXTEEN-INCH MINE PUMP installed in Florida pebble phosphate field by International Minerals & Chemical Corp.



GRINDING MILL installation in cyclone section of Noralyn treatment plant.

Non-Metallics

» Western phosphate getting increased attention. Two more companies enter Carlsbad potash field. Demand for all grades of asbestos exceeds supply.

Phosphate

JAMES A. BARR, Consulting Engineer, Mount Pleasant, Tenn.

EXPANSION OF ELECTRIC FURNACE capacity for treating phosphate rock[1] continues in the Western States. Westvaco Chemical Co. installed a third unit at Pocatello in 1949, bringing capacity to 41,500 kw. Victor Chemical Co. acquired phosphate properties and mines in the Maiden Rock district, south of Butte, and announced plans for an electric furnace plant at Silverbow.

Much interest has been shown in Western phosphate deposits during the year and prospecting work was active and extensive.

Consolidated Mining & Smelting Co. of Canada continued to operate two mines near Garrison, Mont., at a rate of 300,000 tons per year.

[1]Data on phosphate rock in the Western States has been furnished by Duncan King, manager, San Francisco Chemical Co., Montpelier, Idaho.

Anaconda Copper Mining Co. installed a beneficiation unit at its mine at Conda, Idaho, for washing about 450 tons per day of a 7½-ft. hanging wall seam, formerly left unmined. The mill flowsheet will include crushing to ⅜ in. in a hammer mill, washing in a rotary scrubber, dewatering in drags with a vacuum pan at the discharge, and drying in rotary driers. Water will be recovered in a thickener.

The Simplot interests operated their Fort Hall, Idaho, strip mines at the approximate rate of 40,000 tons of rock of fertilizer grade and 275,000 tons of phosphatic shales for the electric furnace trade, namely, Westvaco, an over-all increase in capacity of about 125,000 tons per year. They acquired additional phosphate leases on Crow Creek, northeast of Montpelier, Idaho.

San Francisco Chemical Co. stepped up the output of its strip mines at Leefe, Wyo., and installed a third Raymond grinding mill.

Phosphate Mines, Inc., opened a mine about 18 miles north of Kemmerer, Wyo. After a short period of operation, mine and plant shut down.

In Tennessee and Florida

Tennessee Field Gets New Furnace. There were no new developments in the Tennessee field in mining and plant production operations and capacity expansion. Monsanto Chemical Co. started a new 25,000-kw. electric furnace Jan. 1, 1951, making a total of 105,000 kw.

The old system of mining large blocks of phosphate deposits with company equipment is giving away to operations of the smaller independent contractor who ferrets out small areas and even pockets of phosphate, mines with mobile equipment and hauls in trucks, often driver-owned.

Great Activity in Florida. Several new mines and plants are in the construction or planning stage in the Florida pebble field. Although these are listed as replacements, there will be the usual trend to build bigger units.

Coronet Phosphate Co. has plans for a new mine named Tenoroc near Lakeland to replace the Eleanor mine, which should be exhausted in 1951. It will have a capacity of about 320 tons of feed per hour. The flowsheet will include the usual washer, followed by flotation.

Davison Chemical Co. is designing a complete new mine and beneficiation plant to be located south of Ridgewood. Plans are still in the preliminary stage.

International Minerals & Chemical Corp. installed Humphreys spirals to retreat flotation table tails at the Peace Valley plant.

This company has a mine pump, research and field test program underway, with a new G.I.W. pump of the following specifications:

Size, 16-in. suction and discharge; impeller, 49 in. in diameter; wound-rotor motor, 600 hp.; full load, 504 rpm. Capacity is 7,500 gpm. at 75% efficiency, clear water. Maximum head is 200 ft., or the unit will pump through about 8,500 ft. of fairly level 16-in. pipe line at 30% solids or about 600 cu.yd. per hour. Velocity is 11 to 12 fps.

All International's Florida office and service centers are being moved to the Bartow area. A new office of distinctive architectural lines is being built on the Noralyn road south of the town. The analytical laboratory is being relocated at the Noralyn mine; here also is being constructed a modern shop with complete repair facilities and supply warehouse.

A year's operating experience has proved several innovations in the Florida phosphate field, described as follows:

The Clear Springs Washer

Virginia-Carolina Chemical Co.'s Clear Springs washer is a model of efficiency and simplicity. Tyler "repulping" screens are up to expectations and are doing excellent work. A mud ball disintegrator of new design not only breaks up the mud balls but replaces the usual hammer mill. It is simply a submerged cruciform-type impeller, mounted in a tank with suitable baffles, driven by a vertical motor.

There are no elevators in the washer. The final screens discharge directly into bins located close to the ground. The washed pebble is fed through roller-type slide gates onto an inclined belt conveyor directly into hopper railroad cars all controlled by one man, including the car haul. This is one of the cleanest washers we have seen.

The washer undersize, that is, minus-14-mesh, is pumped through five miles of pipe line. There are six pumps in the line and the whole sequential operation is controlled by one man at the washer. It appears that the line has exceeded design capacities and has been successful from the start.

Innovations by American Cyanamid

The American Cyanamid Co. is installing a new type of wet storage ahead of the drying plant at Brewster. A belt stacker will take feed from incoming hopper cars and deposit onto a radial pile. The phosphate will be reclaimed by belt conveyors in tunnels underneath, which elevate and convey to the drying plant.

With the high cost of fuel oil for drying, wet storages pay off well by lowering the moisture in the phosphate pebble and concentrate from an in-figure of 18-20% to an out-figure of about 14%.

To this company goes the credit of two "firsts." One of these is a new-type thickener installation for reclaiming water from process flows. A 300-ft. Dorr mechanism is located in a 750-ft. diameter pond, making one mechanism do the work of four. When we inspected the installation in December, the peripheral area was relatively free from deposited slime, which seems to migrate toward the center, where it is pumped to disposal ponds. These thickeners reclaim about 90% of the inflow as clarified water and reduce the pumping load of the underflow in proportion.

Operation of the liquid-phase cyclones to replace the conventional hydroseparators has been very satisfactory. A close split, as coarse as 150 mesh, is consistently made; the spigot underflow runs about 70% solids when on automatic control. A change is being made on this mechanism to lower maintenance cost. Both of these operations are at the Sidney plant and are fully described in the article by Arthur Crago, general manager, in the November, 1950, issue of this publication.

More Auxiliary Plants

The increase in numbers and capacities of "pit-mouth" auxiliary or supplemental plants continues.

American Agricultural Chemical Co. is preparing to install an electric phosphorus furnace of 8,000 to 10,000-kw. capacity at the Pierce plant location. The Virginia-Carolina Chemical Co. is again starting up its electric furnace at Nichols; the capacity has been increased from 4,200 to 6,000 kw.

Swift & Co. and Armour Fertilizer Works, with plants near Bartow, are increasing capacities substantially in the production of sulphuric acid and triple superphosphate. Tennessee Copper Co. previously increased production of sulphuric acid and triple-superphosphate at East Tampa.

International Minerals & Chemical Co. plans to build a phosphoric-acid chemical and multiple superphosphate plant near Mulberry.

Research Makes Progress

TVA Develops New Type of Furnace. The Tennessee Valley Authority reports interesting developments[2]:

An unusual type of electric furnace for smelting phosphate was constructed and put into operation recently. The furnace, of 7,500-kw. capacity, has a rotating hearth. Initial operation started in October and, although it is too early to evaluate the operation, TVA engineers expect the furnace to be more efficient and economical than the stationary furnace. Tests with a pilot-size rotating furnace have shown that phosphate fines could be smelted in this type of equipment with a saving of charge-preparation costs.

Calcium metaphosphate, containing about 62% P_2O_5, is being produced in a demonstration unit at Wilson Dam and distributed to farmers in several states. Operation has shown that the product is definitely competitive in production cost with concentrated superphosphate by the electric-furnace process.

Equipment for making phosphate pellets for electric-furnace charge is being completed. Pellets will be made by tumbling phosphate sand and clay in a rotating cylinder and then calcining in a vertical shaft kiln. Much less fuel is required than in the rotary kiln used in nodulizing.

TVA will build a demonstration unit for the production of nitrogen-phosphate or nitrogen-phosphate-potash fertilizers by processes involving acidulation of rock phosphate with nitric acid. The advantage of using nitric acid is that its cost is offset by the value of the nitrogen in the fertilizer.

Increase in Florida Output Anticipated

While the 1949 production shows a decline from 1948 for Florida and Tennessee, sales, or consumption, were[3] reversed: In 1949, 8,987,000 tons was sold as against 8,669,000 in 1948. It is estimated that for 1950, due to uninterrupted labor conditions and larger demand because of increased phosphoric acid production and higher exports, output in Florida will increase over 1949 to approximately 7½ million tons. Output in the Tennessee field has been static for a number of years

[2]Authorized release, by Dr. J. H. Walthall, Chief, Research and Engineering, Tennessee Valley Authority.

[3]This section by H. F. Dengler, Export Sales Manager, Phosphate Div., International Minerals & Chemical Corp.

U.S. Phosphate Production, 1949-1948 [a]

(In 1,000 Long Tons)

	Florida	Tennessee	Western States	Total
1949	6,695	1,403	779	8,877
1948	7,184	1,500	704	9,388

(a) Minerals Market Report, MMC, 1949.

World Shipments of Phosphate Rock 1949-1948 [a]

(In 1,000 Metric Tons)

	United States	North Africa Incl. Egypt	Pacific Ocean and Asia	Various Countries Incl. Russia	Total
1949	9 020	6.395	1,796	2,722	19.933
1948	8,807	6,253	1,157	2,609	18,826

(a) International Superphosphate Manufacturers Association.

and again for 1950 it should be about 1½ million tons. Activities in the Western States are increasing and phosphate output there should reach about 850,000 tons in 1950. The total U. S. output of this commodity in 1950 is estimated at 9.8 million tons.

Various mining companies in Florida are putting in additional equipment and there are indications of expanding markets (see reservations hereafter). It is conceivable that Florida's output for 1951 may exceed the 8-million mark. With Tennessee continuing to contribute 1.5 million tons and the Western States output increasing to 0.9 million tons, total United States production for 1951 is estimated at 10.4 million tons.

An alarming and most likely retarding element is the developing shortage of sulphur, which is essential in the utilization of phosphate rock. If the sulphur supply is curtailed, there will be some reduction in the phosphate consumption.

Statistics for the United States picture were given previously. Figures for North Africa cover Morocco, Algeria, Tunisia, and Egypt with the following 1949 shipments (in 1,000 metric tons): 3,620, 619, 1,937, and 190, respectively. The current year (1950) will see an increase in Morocco, and Algeria and Tunisia will probably remain unchanged. Difficulty in finding markets has prompted beneficiation research and the erection of a local triple-superphosphate plant. Shipments from Egypt (Kosseir and Safaga) in 1949 were much below capacity. Those for 1950 are expected to reach close to 500,000 tons.

It is estimated that the 1950 North African production will total 7 million tons, which will probably be exceeded in 1951.

The "Pacific Ocean" tonnage includes shipments from Ocean Island, Nauru, Christmas Island, Makatea, Angaur and Daitojima. After war damages had been repaired, Ocean and Naura in 1950 reached full capacity at 1¼ million tons. Production on Christmas Island (acquired in 1948 by British Phosphate Commissioners) will be increased, and that on the other islands should remain the same. For 1950 and following years, total Pacific Ocean shipments should be about 2 million tons.

The main item under "Various Countries" is 2.3 million tons produced in U. S. S. R. This is speculative as no reliable data are available. The balance represents shipments from Curacao and local productions in various countries that do not enter world markets.

World Shipments Will Increase

In 1938, the last full prewar year, world shipments of phosphate were 12 million tons. In 1949 they reached 20 million tons. During 1950 more than 21 million tons will be moved and there should be a further 1-million-ton increase in 1951. This estimate is based on production capacities and there is doubt that world markets can absorb the increase. For instance, government policies in a number of countries to subsidize farmers for the purchase of fertilizers are gradually coming to an end and resulting in an increase in price actually paid by the farmer. This has led to a contraction of fertilizer sales, though this should be temporary. Of greater importance is the sulphur shortage mentioned. Exports from the United States to various parts of the world may be drastically restricted. Pyrite and other raw materials may be used in making sulphuric acid but most plants are not equipped for this change and further adequate sources of pyrite must be developed, all of which would take time. This situation may result for a time in a substantial reduction in world phosphate consumption.

In Japan. This country is now back to her prewar consumption of some 800,000 tons annually. In 1949 only 474,000 tons was imported because of large stocks remaining at the year end. In 1950 shipments will be about 750,000 tons, coming from Egypt, Makatea, Florida, Angaur and Daitojima. Attempts are being made to develop fused-phosphate and triple-super plants. Japanese requirements should eventually reach 1 million tons yearly.

It is assumed that the only acidulation plant in South Korea has been destroyed and that the larger plants in North Korea have suffered the same fate.

In India. Progress of the fertilizer industry in India has been rather slow. Shipments of phosphate were 20,000 tons in 1948, 28,000 tons in 1949. Meantime two or three acidulation plants have been completed, so that 1950 shipments are estimated at 60,000 tons and in 1951, 100,000 tons. The sulphur shortage will have severe effects, inasmuch as India imports exclusively from the United States.

Within the Iron Curtain. The Iron Curtain countries and Yugoslavia have not done so badly. In fact, shipments in 1949 exceeded those in 1938, as shown by the following:

Country	1949 (In 1000 tons)	1938
Czechoslovakia	124	115
Hungary	28	28
Poland	231	181
Romania	0	3
Yugoslavia	29	4

Most of the phosphate shipped originated in North Africa. The rest came from the U.S.S.R. (Kola). There is little news about Russia. Rumor has it that, for lack of maintenance, the Kola installations are deteriorating, resulting in reduced output. On the other hand, the Soviet Union is actively soliciting business in Western Europe and not wholly without success.

Barite

R. ROWAND, Production Manager, Baroid Sales Division, National Lead Co., Los Angeles, Calif.

THE BARITE INDUSTRY continued active throughout 1950, enjoying an accelerated demand during the latter part of the year. The chemical industry and oil-well drilling concerns are the principal consumers. Chemically, barite, or barytes, is barium sulphate. High purity is the prime requisite if the ore is to be used in the chemical industry. For use as drilling mud also, barite ore must be of high purity and have desirable mud-making properties when finely ground.

In the order of importance as to tonnage, production of barite in the various states remained as in 1949. Arkansas led in output, all of the barite being ground for use in well drilling, with Missouri in second place. Missouri barite is processed for well drilling and furnished to the chemical industry. Nevada and Georgia follow. Other states with known production are Arizona, Tennessee, California, Idaho, New Mexico and South Carolina.

For the Chemical Industry

In 1949, Missouri's concentrating plants produced 186,981 short tons of barytes, even though operations were curtailed in the latter part of the year. This source supplied most of the domestic raw material for the chemical industry. Washington County barite is normally recovered from near-surface deposits as fragments in residual clay by stripping methods, log-washing and jigging plants. High-grade barite concentrates may be furnished at ½-in. to ⅝-in. ring size to the chemical industry, or to the grinding plants for well-drilling weighting material. Current production statistics indicate that the tonnage in 1950 will exceed that in 1949. One of the larger washing plants has begun operation of a new table plant to treat sands which were formerly a loss or diluent to coarse concentrates.

Georgia furnishes the chemical industry with barite which is produced by methods like those used in Missouri.

Some Nevada ores are of sufficient purity to be mined, crushed and marketed without concentration. No plants for the latter purpose have been put in operation in that state to date.

Tennessee produces ore of chemical grade, and other supplies are imported.

For Weighting Drilling Mud

It is estimated that Arkansas produced about the same tonnage of ground barite concentrates in 1950 as in 1949, when the production was 363,382 short tons. There are two producers, one handling ore from a strip pit and the other from an underground operation. One producer there supplemented primary production with concentrates shipped from Missouri. Arkansas ores are of low grade and require concentration by flotation. It is necessary to grind to 325 mesh to liberate the barite particles, thus giving a product usable as drilling mud. Barite finely ground like this is not readily amenable to use in the chemical industry.

Missouri operators turned out large tonnages of ground barytes for the drilling industry during 1950. A new dry-grinding plant has been in operation since mid-year, which adds to the district potential.

Nevada contributed 60% of its output of 70,576 tons in 1949 to the well-drilling industry. In 1950, the consumption of barite for this use dropped by about one half. None of the Nevada ores used in drilling mud are beneficiated.

Georgia has been a steady producer of ground barite throughout the year and is responsible for some 40,000 tons of weighting material. The bulk of the Georgia production has come from tailings pond reclamation and a combined sink-float flotation process.

Arizona has had production from a plant near Mesa, the primary source being an underground mine. The ore is concentrated by flotation methods and is wholly consumed in the drilling industry. Approximately 8,000 tons of weighting material was supplied the industry from Arizona in 1950.

Idaho barite is supplied by one company which dry-grinds ore from its mine near Hailey without beneficiation.

California has dropped in status as a producer of primary ore, but remains the principal state in the grinding and other processing of western barite. During 1950 most of the ore processed there was shipped from Nevada.

Imports. Statistics on imports of barite in 1950 are not available. In 1949 we imported a total of 26,178 short tons of crude barite and it is believed this figure was exceeded in 1950. Foreign sources are Nova Scotia, Italy and Yugoslavia. Mexican imports were at a low rate during the year. Tariffs remain at $7.50 per long ton on ground barytes and $3.50 per long ton on crude barytes ore.

A New Use. Of recent interest is the use of barite as a heavy aggregate in concrete for the coating and weighting of oil and gas pipe lines, for river crossings, swampy conditions and for protection of the pipe from corrosion. Producers in Missouri are equipped to supply this aggregate in the size range required by the users.

Perlite

S. W. JOHNSON, President, Texas Panacalite Company, Irving, Texas

THE PERLITE INDUSTRY enjoyed a tremendous expansion during 1950. No over-all figures on production are available, but the Perlite Institute's figures show the production by members to be up about 350% over 1949. This would indicate a gross shipment of crude crushed perlite rock in the neighborhood of 50,000 tons, corresponding to about 12,500,000 cu. ft. of the expanded product.

Fifty new expanding plants were put into production in the United States in 1950, bringing the total here to about 75.

During the year the Great Lakes Carbon Co. put its new crushing and sizing plant near Socorro, N. M., into production. The Alexite Co. is reported to have transferred its perlite deposit and crushing facilities to a Denver group headed by Roy Burkett. This deposit is south and west of Colorado Springs, near Texas Creek. The company is said to have a new crushing and sizing plant ready for operation at Florence, Colo. Combined Metals Reduction Co. of Salt Lake City, Utah, has had its new crushing plant at Caselton, Nev., in operation for nearly one year and has been a major supplier of crude perlite all over the United States. The Dantore division of Dant & Russell, of

Portland, Ore., produces crude perlite mainly for its own use and the United States Gypsum Co. is shipping from its perlite deposit near Lovelock, Nev. There are a number of other producers with smaller plants.

Capacity Exceeds Shipments

All production of crude perlite is in the west, there being no known deposits east of the Rockies with the possible exception of a small area around El Paso. Extensive deposits of perlite lavas occur west of the Front Range of the Rockies, although questions as to accessibility, grade, and ease of mining tend to eliminate all but a few. Total present productive capacity of crushed and sized rock is estimated at roughly ten times the estimated shipments for 1950, or approximately 500,000 tons per year.

Two major companies have developed expanding furnaces of their own or have working agreements respecting furnaces. These furnaces are then licensed under a franchise arrangement involving use of furnace and trade-mark and providing for supplying of crude perlite for processing.

Market Highly Competitive

One can see from the excess crude capacity that the market for crude perlite is highly competitive. However, access to a reliable source of good perlite properly sized is of far more importance to the expander than price concessions.

Prices on crude perlite sized to specifications for plaster-grade material range from $6.50 per ton f.o.b. cars in Nevada to $8 in New Mexico and Colorado. The cost per ton on the eastern seaboard runs from $20 to $22 per ton.

In spite of the comparatively high cost of perlite crude, particularly in the east, as compared to sand, perlite is enjoying a rapid development and replacing sand in plaster and lightweight insulating concretes. This is true because it has notable advantages in weight saving, insulation and fireproofing. Also labor savings can be effected, offsetting the higher material cost.

Use of perlite had its first important development in Arizona around Superior and Phoenix. Southern California, particularly Los Angeles, was quick to recognize its possibilities. There have been 15 to 20 expanding plants in the Los Angeles area for the past two years. Several of the more substantial plants are doing a profitable business. The market in the Los Angeles metropolitan area is estimated at 122,000 4-cu. ft. bags per month at present. Perlite acceptance in the east has been rapid and this promises to be the greatest market in the future.

The principal product produced by expanders is plaster aggregate, which is used in place of sand in plaster, also in place of sand in lightweight insulating concrete for roof decks, floors, curtain walls and many other uses. The expanded product weighs on the average about 8 lb. per cubic foot, as compared to sand at about 100 lb.

Competition for markets for the expanded material has caused a substantial break in prices on both west and east coasts. In the Los Angeles area, the price per 4-cu. ft. bag f.o.b. plant dropped from 85c. to 65c. In the east the price went from $1.10 to 95c. f.o.b. plant. Recently prices have advanced about 10%. Due to the bulk of the expanded product and the resultant high freight rates, it is not shipped any great distance and there is a wide range of prices over the country, depending on the competition in any area.

As to the expanding furnaces, a trend seems to be developing toward two basic ideas: The stationary horizontal or slightly inclined furnace and the vertical updraft furnace. In both types expansion takes place in the combustion chamber in direct contact with the flame. The fuel is usually gas. There are variations of these two general types. In the horizontal furnaces, preheating has been introduced during the year. With preheating, it is claimed, closer control of expansion is possible with production of less fines. However, it is doubtful that preheating is necessary. In general, the vertical updraft furnaces have greater capacity and are more economical to operate.

Some New Developments

Perlite has risen from the status of a virtually new product to that of a basic material recognized by architects and building contractors throughout the country.

Among the new developments are standardization of plaster aggregate, the labeling of a uniform product through the efforts of the Perlite Institute, the development of some 25 tests for the protection of lumber and steel up to four-hour ratings issued by the National Bureau of Standards and the Underwriters' Laboratories, Inc., and the labeling by the Underwriters' Laboratories of the product of many of the processing plants.

A research program is being conducted under the auspices of the Perlite Institute at the John B. Pierce Foundation, Raritan, N. J., on the use of perlite as a concrete aggregate. Perlite is finding ready acceptance in roof decks, insulating floors and roof and floor fills.

Will Save Steel

Use of perlite with its high rating as a fireproofing material would have effected an estimated savings of 40,000 tons of steel in 1950. The present shortage of steel will bring the attention of designers to perlite.

A further new development is the use of perlite in exterior panel walls of fireproofed buildings, as it has secured a four-hour rating for a 6-in. thick wall to replace outmoded 18-in. to 24-in. masonry walls with a lighter, more fire-resistant and less expensive construction. This wall faced with an aluminum facade will be used in the gigantic Aluminum Company Building in Pittsburgh, adding thousands of square feet to the rentable area.

An entirely new concept in building construction has been introduced through the use of perlite. Savings in dead load and structural steel can be greatly increased, and along with these savings, superior buildings, better fireproofed and insulated, can be attained through its use. In a sense, the building industry can now take its place in this streamlined age along with automobiles, trains and airplanes where dead load is a mortal enemy, and styling and comfort are reaching new heights.

Potash

G. T. HARLEY, Manager International Minerals & Chemical Corporation, Carlsbad, N.M.

PRODUCTION OF POTASH in the Permian Basin of the Southwest was at a standstill at the beginning of 1950, due to a prolonged strike by the International Union of Mine, Mill and Smelter Workers. At that time of the year a strike was of such economic importance that the

House of Representatives' Subcommittee on Agriculture requested Secretary Brannan to help end it. It is during the period Jan. 1-April 15 that 70% of the annual production of potash is consumed normally, according to the estimate of L. G. Porter, fertilizer specialist, or 700,000 tons of potash (K_2O equivalent) and only half of this amount would be available, should the strike continue. The three producing companies in the area, namely, International Minerals & Chemical Corporation, Potash Company of America, and United States Potash Co., all within 25 mi. of Carlsbad, N. M., produce 85% of the country's potash.

The outcome was that the Mine-Mill union suffered a bitter and total defeat, and abandoned the 73-day strike on Jan. 31, when it became obvious that the back-to-work call issued jointly by the companies two weeks earlier would be successful in breaking the strike.

The terms of the settlement did not differ materially from the conditions that had been offered in joint negotiations with the union prior to the work stoppage.

Two new prospective producers actively entered the Permian Basin during 1950, namely, Duval Sulphur & Potash Co. and Southwest Potash Co. These, together with the three companies already mentioned, will bring the number of producing companies in the Carlsbad area to five. Both of the new companies plan to use flotation processes and expect to spend a combined total of $13 to $14 million dollars within the next two years to complete their facilities. United Gas Corporation is the parent company of Duval and holds about a 70% interest in it. Southwest Potash Co. is a subsidiary of American Metal Co.

Operating Changes

Although no great changes in mining or refining methods were made during 1950, many minor changes and innovations were developed by the various companies. Two of the operators purchased diesel-driven Caterpillar bulldozers for use underground to clear roadways, stack gob, and clean up the floor for the Joy loaders. Permission to use this type of equipment has been given by the New Mexico State Mine Inspector after an efficient exhaust scrubber had been developed.

Roof bolting on a limited scale was tried and has proved to be highly satisfactory thus far.

Experiments were carried on with hydraulically-operated boom-mounted drills, operated from rubber-tired carriages. Increased life for under-cutter bits has been attained through the use of a redesigned tungsten-carbide insert. This new insert does not crack or peel off as easily as the insert in the former type. Refinements in face drilling, primarily in the selection of the size and design of the drill bit, have resulted in decreased powder consumption and better fragmentation.

Radio Used Underground

Several innovations to further safety and to increase the efficiency of haulage and hoisting have been installed. They include: (1) two-way short-wave communications; (2) solenoid-operated rail switches, remotely controlled to permit throwing of the switches from a moving locomotive; (3) automatic current-limiting dynamic braking on locomotives, and (4) electronic shaft-signal systems to allow communications by voice between levels and between hoistman and levels.

International Minerals & Chemical Corporation is currently sinking one shaft and planning to sink another early in 1951 to develop their existing ore reserves further. To eliminate any difficulties which might arise when sinking through the water-bearing stratum, these new shaft sites were sealed from the surface prior to sinking by drilling a series of holes around the shaft into the known water-bearing stratum and sealing the entire area by pre-grouting with concrete under pressure.

Potash Company of America is in the process of sinking one additional shaft. An interesting feature of the project is the freezing of a zone of quicksand which has been encountered. The stratum of quicksand will be frozen by cold brine from a temporary refrigerating plant, circulating through pipes in drill holes closely adjacent to the shaft section.

The United States Potash Co. installed a new 90-ft. steel headframe at its No. 2 shaft for auxiliary hoisting and servicing of their mine.

In the Refineries

Refining facilities of all three producing companies have been increased during 1950. The United States company installed a complete unit for continuous flow dissolving, as well as an additional crystallizer and filtering unit. Both the Potash Company of America and International have increased their refining capacities through metallurgical improvements and more efficient utilization of production equipment; however, no changes in the basic metallurgy of their flotation processes were made.

A new plant for the production of sulphate of potash is being built by Potash Company of America at Dumas, Texas. It will utilize the Hargraves process. The byproduct hydrochloric acid will be supplied to petroleum operators of the immediate region for use in oil-well acidizing.

Asbestos

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DESPITE A PRODUCTION of all grades of asbestos in 1950 that was the highest in history, supply still could not keep pace with demand. Due to ignorance as to the amount of fiber produced in Soviet Russia, accurate world figures cannot be compiled; and this is particularly true because that country is probably second only to Canada in asbestos mining and milling facilities. From best estimates and belief, however, it is safe to say that Canada produces at least 70% of the world's total chrysotile and the figure is in all probability nearer 80.

All classifications of fiber are still in short supply. Some are critically so, such as the spinning grades. Contrary to an opinion which became prevalent as housing and other credit controls were applied during the Korean crisis in the United States, the continued purchases of all grades of fibers by makers of asbestos products were hardly, if at all, being made for stockpile purposes. The effect of the four-and-a-half month strike, which was practically industry-wide in Canada during 1949, had not been taken fully into consideration. Nor was the terrifically increased tempo of U. S. industrial production in 1950 foreseen. Thus 1951 began, with the world's asbestos producers striving to the utmost to increase output, particularly in the Dominion of Canada (where production has reached the

highest degree of mechanization).

Preliminary year-end figures of the Dominion Bureau of Statistics give the tonnage of all grades produced in Canada during the year as 877,650, having a gross value of $64,931,931. This compares with 717,000 tons and $42,200,000 for 1948, which was the last full year with which a comparison can be made. Since there are about 270-275 working days in Quebec to the operating year, the daily production exceeded 3,000 tons.

Shorts Two-Thirds of Total

Of this production, crudes accounted for between only 0.1 and 0.2%; spinning fiber from 4 to 5; shingle, approximately 18 to 20; paper, about 12; cement possibly 20; Group 7 "shorts," including some 2 to 3% of "sands," the balance, or, say, 45% of the total output. Thus, fiber composing Groups 1 and 2 (the crudes) through Group 5 accounted for one-third of the total; the sixth, seventh and eighth group "Shorts," two-thirds. This is the same ratio as applied in 1948 and indicates that the average rock treated by the Canadian industry throughout the year is showing little if any change in proportionate yield.

Canadian prices were increased late in October for all grades, the average increase having been about 10%. This was the first step-up in almost two years, a total of some 50% since price controls were removed in 1946.

The greatly increased production in 1950 appears to have resulted from increased milling capacity rather than from a mere attempt to extract a higher proportion of shorts from the rock mined. Thus, whereas in 1948 the Asbestos Corporation had four mills operating with a total capacity of slightly over 11,000 tons of rock per day, in 1950 the same mills had been stepped up to an average rate of almost 14,000, most of the increase coming from the British-Canadian at Black Lake. Canadian Johns-Manville's new Munro (Ontario) mine and mill commenced production about the middle of the year. Initial difficulties reportedly due to the combination of harsh and soft fiber to be treated in the same rock should soon be overcome and this newcomer in asbestos production will in all probability become more and more important as time goes on. For 1951 the objective in fiber output of all grades is placed at 30,000 tons.

The same company's major plant at Asbestos, Que., continued to be the industry's single largest, both in tonnage of rock treated and fiber produced. No step-up in capacity, however, has been reported for the year, the tonnage treated being in the neighborhood of 10,000 daily.

Nicolet is now operating at a 2,400-ton rate, its capacity having been substantially increased. Bell's one major plant at Thetford has been stepped up slightly, but continues to operate on better than average (of the district) rock. Johnson's Thetford and Black Lake mills have maintained constant production and the new wet-process plant (said to have a daily capacity of 3,000 tons) has been working on reprocessing tailings. Flintkote's operation near Thetford has increased its capacity to 1,200 tons a day and the east half of the asbestos zone, which runs uninterruptedly across the property, has now been fully developed. It shows a far larger tonnage, and over greater widths, than the west end, formerly mined. This development is said to constitute a new mine in itself. Philip Carey's Quebec Asbestos at East Broughton is maintaining its production at capacity.

Assuming the same recovery as reported for the last full year, 1948, namely, 6.66% for the rock as mined and the same percentage of rock rejected to waste, 26.6%, it would appear that 14,000,000 tons was mined in Canada in 1950 and approximately 10,275,000 tons milled, a daily average for 270 days of 38,000. This compares with slightly less than 29,000 calculated for 1948. The average value of fiber produced appears to be about $74 per ton[1] as opposed to $58.88 for 1948. The place-value of the ore—as mined—approximates $4.60 per ton[1], compared to $3.92.

Four New Mills

Plans for erecting four new mills in the Quebec district are being discussed. Three are for recently developed orebodies not previously mined. The most important of these is for the Johnson's Co.'s property about half way between Thetford Mines and Black Lake. There, drilling to depths of over 750 ft. is reported to have indicated one of the richest discoveries since the early days of asbestos mining in the province. The mill proposed may have a capacity of 4,000 tons of rock per day or better.

On the 1946 discovery adjacent to the Johnson's Co.'s, a new company has been formed, Asbestos Producers Corp., and financing is being arranged for building a mill and opening the mine. A first unit of 500 tons daily capacity (which may be raised to 1,000) is being discussed. The third recently developed orebody (1945 and thereafter) which may relatively soon be placed in production is that belonging to the newly organized Dominion Asbestos Co. which took over the assets of what was formerly International Asbestos. A 1,000-ton per day development is understood to be the objective.

On the site of what was formerly Coleraine Asbestos (the old Paré mine), the recently organized Continental Asbestos plans a 250-tons a day operation. However, under present war and mobilization exigencies it is doubtful that the new construction will be translated into expanded fiber production before middle or late 1952.

Chrysotile in U. S.

In the United States, chrysotile output in Arizona continues to be small and relatively of minor importance. The output of some crude and spinning fiber (iron-free) crude and required for high-tension electrical insulation, is, however, important. In Vermont, the Ruberoid Co.'s new plant is steadily operating at a feed rate of 2,000 tons daily. Small amounts of Group 3 fiber are turned out; but the major output consists of Group 4 material and shorter. It is the only operation as yet producing in the United States comparable to Quebec; though what may prove to be a major deposit is understood to be under investigation in California by Johns-Manville.

Lacking information about Soviet asbestos production, we may say that Rhodesia continues in second place in free-world asbestos production, but the order of such production is only about one-tenth in tonnage of that of Canada. The average value of the fiber is much higher, however, due to their great distance from points of consumption. The old-line companies have increased their output only slightly and the many small new independent operations which have sprung up are producing usually but minor quantities of relatively poor fiber, often badly graded, dirty and highly priced. The Rhodesian as well

[1]Final, corrected and detailed statistics for the Canadian asbestos industry are usually not available until March or April of the succeeding year.

as the South African operations employ a big amount of labor and enjoy a relatively low degree of mechanization compared with Quebec.

In South Africa the production of both Cape Blue (crocidolite) and amosite has fallen off somewhat in the past year, due, it is claimed, to labor shortages. Nor can any increase in production be expected for 1951.

Cyprus continues to contribute to the world's supply from one operation which is reported to produce some Group 4 fibers, but mainly Group 5 and shorter. Italy continues its output of both tremolite and chrysotile.

Japan's economic rehabilitation has also been extended to the renewal of asbestos production. Though of a minor order, the output, mainly of short fiber grades, is becoming of greater importance. France has constructed a mill to treat tremolite ores containing spinning grades, and Yugoslavia is planning development of its deposits.

In conclusion, the entire world is for the first time apparently becoming asbestos-conscious and, in every country, prospecting for this common mineral, found, however, in commercial quantities so rarely, is proceeding at an unprecedented rate. One new discovery of the sort, in Morocco, may become of major import. No other new fields of any promisingly large potential have been reported excepting that (as mentioned) at Munro in Ontario which Johns-Manville has placed in production within the past year. Lack of space prevents further production figures by countries or descriptions of the operations throughout the world. The reader is referred for such detailed information, country by country, to the magazine "Asbestos," published in Philadelphia. For what the Canadian industry is doing to meet present-day consumption requirements, prospecting, mine-wise, mill-wise, new techniques, new properties, has been rather thoroughly detailed in a recent article in *Engineering & Mining Journal.*

Fluorspar

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RECORD CONSUMPTION and imports, wage increases, higher prices, abrogation of the reciprocal trade agreement with Mexico, and transfer of fluorspar to the list of strategic and critical materials for stockpiling were some features of the fluorspar industry in 1950.

Consumption of fluorspar in the United States in 1950 probably will prove to have exceeded slightly the all-time record of 410,170 short tons established in 1944. The steel industry, which also set a new record in 1950, continued to be the predominant user and absorbed about 57% of the total consumed; usage was about 20% greater than in 1949. However, because of the smaller utilization of fluorspar per ton of steel made, total consumption in steel fell short of the record made in 1942. The hydrofluoric-acid industry, the second largest user, accounted for about 29% of the total quantity consumed in 1950 and used about 38% more than in 1949. Use of fluorspar in making this acid increased progressively during the year and was at a near-record rate during the latter half. Fluorspar was consumed by the glass trade at about the same rate in 1950 as in 1949, but there was a substantial gain in usage in the enamel industry.

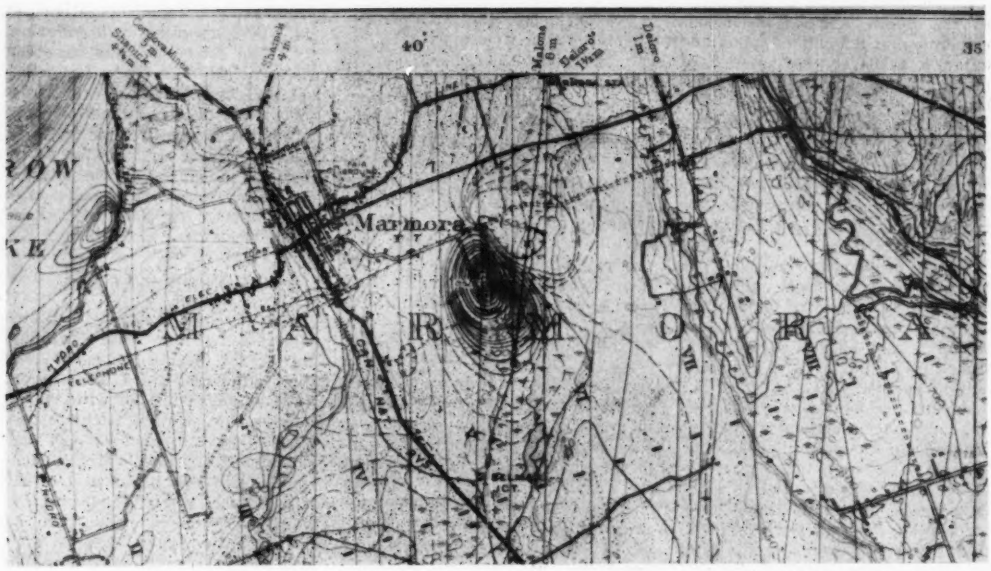
Domestic production in 1950 was substantially greater than in 1949. Shipments from mines in 1950 exceeded production and were likewise much larger than in 1949, but fell far short of meeting industry's requirements. The Illinois-Kentucky district continued to be the chief source of domestic fluorspar, and shipments of metallurgical and acid grades were up substantially. Metallurgical-grade fluorspar was shipped from other producing states at only a slightly higher rate in 1950 than in 1949 despite much greater activity by producers in the Topaz district, near Delta, Utah. However, shipments of acid-grade feldspar from other states increased substantially. The Wagon Wheel Gap mine of the Colorado Fuel & Iron Corp., near Creede, Colo., was closed during the third quarter; it had been producing fluorspar for the company steel works at Pueblo, Colo., since July 15, 1924. Texas Fluorspar Mines, Inc., discontinued operations at the Eagle Mountains mine and flotation mill near Van Horn, Texas, in June, 1950. Inland Steel Co. suspended operations at its Keystone mine, near Marion, Ky. The Keystone mine has been an important producer for many years. Inland Steel Co., which discontinued fluorspar mining and milling in Illinois in 1948, recently sold the mineral rights of five tracts in Hardin County and the flotation mill, gravity mill, powerhouse, and headframe at Rosiclare to the Kentucky Fluor Spar Co., Marion, Ky.

New High in Imports

Imports into the United States established a new record in 1950. During the first 10 months of 1950 they amounted to 110,534 short tons, which compares with 95,619 tons during 1949 and with the previous all-time high of 111,626 tons established in 1948. Mexico continued to be the chief source of the imports in 1950 and, despite car shortage, supplied more than in 1949. Much larger imports were also received from Spain, which supplied a substantial quantity of acid-grade fluorspar. Noteworthy was the receipt of 10,770 tons of metallurgical grade and 4,693 tons of acid-grade fluorspar from Germany during the first 10 months. Fluorspar was imported from Italy and Newfoundland at lower rates than in 1949. A shortage of hydroelectric power adversely affected operations of the St. Lawrence Corp. of Newfoundland, Ltd., which exports much of its output to the United States. The Ozark-Mahoning Co., which operates flotation plants at Rosiclare, Ill., and Jamestown, Colo., began operating its drying plant at Wilmington, Del., in June, 1950. Acid-grade filter cake from the flotation mill serving the Osor mine in Spain is dried at this plant and the dried concentrates are shipped to Eastern consumers.

The reciprocal trade agreement between the United States and Mexico, which had been in effect since Dec. 28, 1942, and provided for a duty of $5.62½ a short ton on fluorspar containing not more than 97% calcium fluoride imported into the United States, was abrogated Dec. 31, 1950. Consequently, the duty reverts to the former rate of $7.50 a short ton. That on fluorspar containing more than 97% calcium fluoride remained unchanged at $3.75 a short ton.

Stocks of fluorspar held by consumers on Sept. 30, 1950, were sufficient for only about four months' consumption at the third-quarter



AERIAL MAGNETIC MAP recently published by Geological Survey of Canada reveals magnetic anomaly (concentric lines) existing over iron ore deposit. Vertical lines are flight lines followed by airplane bearing magnetometer.

Airborne Geophysical Methods Make Further Strides in 1950

The authors discuss (1) Latest concept of the role of geophysics in mineral exploration, and (2) Significant advances in airborne geophysical techniques.

HANS LUNDBERG and BASIL T. WILSON, Toronto, Ontario.

THE RECENT HAPPENINGS in Korea, Indo-China and Tibet have shocked many peoples of the democratic way of life and united them into a striking force against aggression. To maintain such a force, the industries behind the armed forces are called upon to produce to capacity. Such production causes an abnormal drain on the natural resources, and once again we must ask ourselves as producers of metals and oil: "Are we finding new sources of supplies as fast as we are depleting them?"

It is impossible to give a comprehensive answer to this question. Thanks to the aggressive action of the staffs and executives of some companies, considerable tonnages of iron ore have been found in Canada and Venezuela in the last few years. This has increased our reserves of iron ore, but for other metals, greater efforts must be made to find new deposits.

I. The Role of Geophysics

At the annual meeting of the AIME in February, 1950, during the round table discussion of the question, "Why hasn't geophysics been applied more extensively to the mining industry in the past, and what should be done in the future?" it was very evident that this effort was foremost in the minds of those in charge of exploration.

This discussion focussed attention on geophysical and geochemistry as tools in modern exploration and showed clearly that opinions differ widely as to the usefulness of the methods as well as to the manner in which they should be applied. The majority at the round table discussion, however, felt that geophysical methods, if properly applied and under strict geological control, could be of general use in the search for ore deposits.

Two different trends in the application of geophysical methods in prospecting have developed. One trend supported chiefly by members of the exploration departments of large mining companies maintains that mining companies should have on their geological staff at least one member qualified to carry out geophysical exploration, and have this part of their organization explore the vicinity of their mines or areas where geological work has indicated favorable geology, but where the accurate outlining of contacts, shear zones and other structures is impossible without the aid of geophysics, owing to considerable drift cover.

On the other hand, if larger areas are to be explored, particularly if such areas can be surveyed by airborne instruments, the work, so far,

has been performed by geophysical prospecting firms or by Government agencies. The reasons for this division of responsibilities are as follows: If the amount of geophysical work needed in the every day routine of planning the exploration of a mine or its vicinity would require only a few days' time to complete when carried out by people intimately familiar with the geology, it would be impractical to call in a geophysical firm to do the work. However, for surveys of very large areas, the mining companies do not usually consider it good economics to maintain equipment and staff sufficient to do the work.

The second trend in modern geophysical exploration maintains that all geophysical work should be carried out by companies specializing in this type of work. It is also emphasized that the geophysical firm should act as a consultant to the mining firm after completion of the survey, so that a revision in interpretation may be made as new geological data come to light during the course of development.

The reason offered for this opinion is twofold. First, it is believed that firms specializing in geophysical exploration will be better qualified to carry out the work and also to make the interpretation. However, a very close cooperation between the geophysicist and geological staff of the mine is always essential.

The second reason is that a geophysical firm has up-to-date equipment to carry out the surveys and is using the most suitable methods, whereas mine staffs, as a rule, only can resort to magnetic, self-potential or perhaps resistivity methods.

Finally, geophysical firms require the support of the more established mining companies so that they can carry out surveys at a reasonable cost and also be in a position to maintain a research branch to improve the resolving power of the various techniques as well as improve their methods and equipment.

A recent trend has been to place the responsibility on Government organization for the development of new geophysical techniques for mining exploration. This has produced some good results, as for instance the research carried out by the Geochemical Department, U. S. Geological Survey, where the value of geochemical exploration for certain types of ore has been fully demonstrated.

The location of a magnetite deposit in southeastern Ontario by airborne magnetic surveys carried out by the Geological Survey of Canada is another example.

However, many feel that there is a danger that such work may lead to the Government branching out from exploration into the development field. Such a trend would gradually lead to the nationalization of mines and industry and is therefore not desirable.

2. Major Advances in 1950

In the above, we have discussed the trends in geophysical exploration during the past year. A great many advances have been made in the instrumentation and methods of prospecting for sulphides and oil bearing structures by electrical, especially airborne, methods, and in prospecting for radioactive minerals and oil-bearing structures by radioactive methods. The former method was reported on last year and the improvements in instrumentation and techniques of interpretation are progressing so rapidly that it has been possible to establish an operational routine.

Radioactive exploration has also had new developments in that the detectors have been made airborne. The geophysical section of U. S. G. S. has carried out airborne radioactive surveys in areas where pitchblende might be expected. Results have indicated that it is possible to eliminate unfavorable areas and to direct attention to sections favorable for the occurrence of radioactive mineralization. The conventional Geiger-Muller counters were used in this work.

In Canada, work has been carried out by at least two private companies using the airborn scintillometer as developed at the University of Manitoba.

One company has used this instrument in Northern Saskatchewan in search of pitchblende, and another company has successfully carried out test surveys over several oil producing areas in Saskatchewan and Alberta.

Fluorspar (*Continued from page* 105)

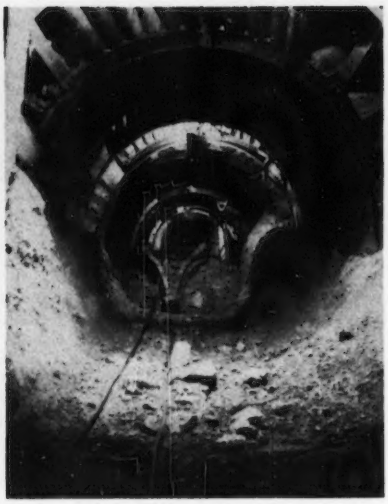
rate of usage, and stocks held by producers was abnormally low.

An average hourly wage increase of about 10c. was made by fluorspar mining companies in the Illinois-Kentucky district in 1950.

Metallurgical-grade fluorspar with 70% or more effective calcium fluoride content was quoted at $37 a short ton, f.o.b. Illinois-Kentucky mines on Jan. 1, 1950, but advances of $2 a ton were made on Sept. 14 and Oct. 26. Corresponding increases were also made in the prices of other grades of metallurgical fluorspar. Imported metallurgical-grade fluorspar was quoted throughout 1950 at $38-$40 a short ton at Atlantic seaboard, duty paid. Acid-grade fluorspar containing 97% calcium fluoride was advanced $3 a ton on Oct. 12 to $46.50 a short ton, f.o.b. Illinois mines.

Metallurgical and acid grades of fluorspar have been transferred to the list of strategic and critical materials for stockpiling by the Munitions Board, and stockpile objectives have been approved for acid and metallurgical grades. Specifications governing the purchase of both of these grades have about been completed.

Consumption of fluorspar in 1951 is expected to approximate 450,000 short tons, and usage will increase as the Government's defense program progresses. The announced expansion of 10,000,000 tons in the capacity of steel plants presages an additional annual requirement of about 27,000 tons of fluorspar, and the expanded aluminum production will also require substantial tonnages. To meet the needs of industry, therefore, and the Government stockpile objectives for fluorspar, it will be necessary to work active domestic mines at capacity, reopen several inactive mines, develop some new mines, reactivate inactive flotation plants, and purchase a substantial tonnage from foreign countries. Under the Defense Production Act of 1950, Federal aid for expanding productive capacity and supplying strategic and critical minerals can be obtained in the form of (1) Government guarantee of private loans, (2) direct Government loans, and (3) procurement contracts. Applications for loans and procurement contracts should be made to the Defense Minerals Administration, Washington, D. C. A fourth method, accelerated amortization for tax purposes, is available under the Internal Revenue Act, applications for which are handled through the National Security Resources Board, Washington, D. C. A program for assisting in exploration is under consideration by D. M. A.



STEPS IN PROGRESS UNDERGROUND — Left, This bulldozer of many uses is electrically driven—the first of its kind. Converted by Tennessee Coal, Iron & Railroad Co., Birmingham, from a standard machine, for service in company's trackless mining program, it will soon be supplemented by electrical units specially built for them. Right, Steel sets such as these are being tried by a copper company in the Southwest for support in draw lines in areas of heavy ground in place of standard timber sets such as have customarily been used.

Carbide's Role in Drilling

A. H. HUBBELL, Managing Editor

SPURRED BY RISING COSTS, mine operators are scrutinizing more closely than ever the unit operations that enter into ore production, seeking chances to improve them. Drilling, blasting, and ground support lead in getting this attention. Loading and transport (and other operations) also are being studied, especially where trackless mining has been introduced or the chance for adopting it is good. A trend toward maximum possible mechanization is apparent, a movement that should help costs and ease the problems of labor shortage and other labor difficulties. The "continuous miner," already widely used in mining coal, is currently being applied to production in the nonmetallic field.

Continuous Mining

In Potash and Borax. The Joy company has two of its "continuous mining" machines at work abroad in the potash mines of the French Potash Co. in Alsace. Early 'Fifty-One will see one in the Carlsbad potash field, New Mexico, and still another in a borax mine in California. (This manufacturer shipped his No. 100 continuous mining machine to a coal company in November and now claims to have the machine working in practically every coal seam in the United States, ranging from 38-in. seams to others that are thick.)

An experienced coal operator holds that two factors that probably will govern the success of this method are continuous transportation of product from machine to preparation plant, and control and support of roof to permit operating without delays. Continuous mining is a system of component operations that must be timed and coordinated to permit the desired continuity.

Blast-Hole Drilling

Single-Use Bits vs. Carbide Bits and Tips. Blast-hole drilling continues to get much attention. Testing and experimentation with different types and makes of bits by mining companies is widespread. The equipment picture is complicated, as is often the problem of selection. Drilling media include old-fashioned sharpened steel (some is still in use), multiple-use and single-use steel bits, detachable carbide bits and carbide-tipped steel. Some forged alloy steel (bits forged on alloy rod) is still used by eight Ontario mines for certain work (*E&MJ*, Dec., 1950, page 105). Diamond drills are currently drilling blast holes for about 30 mining companies, mainly in Canada and the United States, though the spread of this practice has been checked, for the time being at least, by rising prices for diamonds (*E&MJ*, Sept., 1950, pp. 96 and 97).

Of the competitive bits, interest centers at present on the single-use or throwaway-type steel bit and the detachable carbide bit and carbide-tipped rod.

Comment From Field. Samples of comment on single-use bits are listed. The letters A, B, C and D, etc., have been substituted for bit names where comparisons might otherwise be awkward:

"For 18 months we have been using 'D' single-use bits exclusively, except in very hard and solid chert and quartzite . . . very satisfactory . . . average 15-20 ft. of hole per bit at a cost of about a cent, or a little more,

Highlights of Current Underground Mining Practice

1. CONTINUOUS MINING, now two years old and already widely applied to coal mining, is being introduced in potash mining at home and abroad, also in borax production.

2. TRACKLESS MINING has greater prominence for extracting metallic ores of suitable deposits, thanks to revelation by Birmingham's largest ore producer of its extensive operations and plans.

3. SINGLE-USE BITS continue to find favor where ground is not too hard and where shop problems can be made easier or eliminated by their use.

4. CARBIDE DRILLING, both with bits and with tips, has unquestionably come to stay, provided insert manufacturers are not restricted in obtaining tungsten and cobalt raw materials.

5. USE OF THE FAST-DRILLING COMBINATION of light airleg-mounted machine and carbide-tipped steel is being pushed for Western mining, following hard on its successes elsewhere, particularly in Canada.

6. CONNECTION BETWEEN DETACHABLE BIT AND ROD is decreasingly a topic of complaint. The thread is more widely accepted as the means of attachment.

7. INCREASING USE OF THE SMALL HOLE that can be drilled with carbide bits focuses attention on the extent to which practice and equipment employed in breaking ground have developed around the use of carbide.

8. LONG-HOLE DRILLING with carbide bits and coupled rods is increasingly inviting trial within the conditions that limit it. Further spread of blast-hole diamond drilling has been checked. The outcome of this competition probably depends on diamond supply and price and availability of cemented carbide.

9. SHORT-PERIOD DELAYS are finding greater use. Advantages emphasized include better fragmentation, less shock, and economy in powder.

10. ROOF BOLTING and greater use of steel and concrete are winning wider recognition as means for supporting ground.

Gives It Critical Importance

per foot . . . have found these bits operate better in our types of ground, if we have a single sidehole outlet for water instead of usual center hole. We use 1¾-in. starter with ⅛-in. changes."—Park-Utah Consolidated, Utah.

"Single-use detachable bits are used in all stoping work. All development and exploration done by contractors, who have detachable carbide bits. Starters in each case 1¾-in. Pretty well satisfied, but are continuously searching for means to improve our performance."—Sunshine Mining Co., Idaho.

"Have completed changeover from 'E' multi-use steel bits to 'D' single-use bits. Results indicate substantial savings in direct cost of bits plus indirect savings in faster drilling, lower powder consumption, lower machine wear due to use of smaller-diameter bits drilling smaller holes."—Combined Metals Reduction Co., Nevada.

"The 'D' single-use bits have been used in one mine for three months. Their penetration is slightly faster than with the 'E' multi-use bit used in other mines, but the gage is smaller than that of 'E' bit. Savings in cost per ft. drilled with 'D' bit is $0.00754."—American Zinc Co. of Tennessee.

"Have used 'D' single-use bits extensively at one mine, particularly at one shaft. Experiments indicate they are neither practical nor economical in hard rock as compared with 'F' or 'G' carbide bits. However, where ore is too hard for efficient use of auger steel, the 'D' single-use bit is satisfactory, also cheaper than the 'F' carbide bit, with drilling time far ahead of latter. The pilot skirt keeps the hole from plugging in a soft seam. . . . At another mine, the use of 'B' single-use bits has been extensive in rock work where the rock is softer than in first mine's shaft. Tests are inconclusive."—Cleveland-Cliffs Iron Co.

Of three Canadian mines, one is using Craig bits, the second P.M. bits, and the third Throwaway bits. All three are single-use bits. A fourth mine was using "A" single-use bits but is now using "B" single-use bits.

"Single-use detachable bits were tested and will be standard practice in 1951."—Patiño Mines and Enterprises, Bolivia.

"Tried out two makes of single-use bits with negative results."—Tennessee Copper Co.

"Use of single-use bits appear to give more efficient results than were attained with forged bits or multi-use steel bits."—National Lead Co., Missouri.

"During 1950, operations in Utah have converted entirely to single-use bits for normal rock conditions and to carbide bits for extremely hard rock."—United States Smelting.

"When using multi-use steel bits, we employed 22 men to make up, recondition, straighten drill rods and grind about 4,000 bits a day. Later, when 100% on single-use bits, we used 10 men to make up and recondition rods—a saving of 12 men."—A copper company.

The present status of the single-use steel bit is regarded by a bit manufacturer's engineer (whose company does not make such a bit) as favorable to those operators who have a definite labor problem or difficulties in reconditioning multi-use bit. He thinks that its future is dependent on the economic situation. Possible shortage of good electric furnace steel in an all-out war effort might interfere with its production.

Carbide Important to Mineral Production

Possible Snag for Carbide Drilling. As to the status of the removable carbide bit, the same engineer regards its present position as excellent, with a reservation noted hereafter. Manufacturing processes have been worked out.

Bits and inserts are produced in quantity with great uniformity and a high degree of perfection. Drillers have been trained in the use of the bits and know their limitations. As a result, the carbide-insert bit has attained wide use. But the outlook for its continued production is not too good, because of the strategic importance of tungsten and cobalt of which it is made.

Presumably, under any emergency program imposing end-use restrictions on strategic metals, due regard will be shown for the importance of carbide to mineral production by permitting carbide-insert manufacturers to obtain the necessary tungsten and cobalt. Any shortage will work to decrease the output of metals and minerals.

As another bit manufacturer's engineer sees it, tungsten carbide makes possible the greatest economies in mining yet produced. He thinks, hopefully, that the National Emergency Administration can be made to see the light.

A. T. Holman, of Holman Bros., Camborne, England, points out that various improvements made in drilling equipment hinge on the reliability and long-life of the modern tungsten-carbide bit.

Should the carbide bit become hard to get, a return by the mining industry to the multiple-use steel bit might ensue.

As a result of the threatened shortage of cobalt and tungsten, scrap carbide, consisting of worn-out bits, has suddenly become interesting to at least two companies because of its content of these metals. One is the Wah Chang Corp., New York.

What Others Think of Carbide

The Carbide Bit in Use. Comment from operators as to their experience and practice follows. Letters F, G, etc., have been used instead of names to avoid invidious comparisons. (Experience with carbide-tipped steel is given elsewhere):

"Use of 4-winged carbide-insert bits for all rock drilling was continued during 1950. A 2-in. starting gage is used for all long-hole drilling, and a 1½-in. bit in all development work."—Chelan Div., Howe Sound Co., Washington.

"Both 'G' and 'F' carbide bits have been tried, their use confined mostly to development headings. The former is now in use and proving satisfactory."—Hecla Mining Co., Idaho.

"Insert detachable bits are used in development when highly siliceous ground is encountered. They permit completing a cycle in 8 hr. when use of steel bits would require 16 hr. Under these conditions we are averaging slightly less than 300 ft. per carbide bit."—American Zinc Co. of Tennessee, Mascot.

"Using 'G' carbide bits, having formerly used 'F' carbide bits. With either we drill 14-15 in. per minute. Bond in former between insert and steel stands up well. 'G' bits averaged 146 ft. in a rock raise, while 'F' bits were worn out in comparable ground after 120 ft. At first, inserts would come out but now many bits are worn down after a number of grindings until only a little carbide is left. This improved bonding is true of both 'G' and 'F' bits."—Eastern iron mine.

"Have extended use of carbide detachable bits to most drilling in ore and rock." (A year ago this operator said: "Results from 4-pt. 'G' carbide bits have been satisfactory when using 45-lb. jackhammer in hematite, drilling 24 in. per minute; also in quartz slates and greenstone where a 3-in. drifter may penetrate 8 in. per minute.")—Gogebic Range iron mine.

"Now using for all raise work 'F' carbide bits of 1¾-in. gage with CR58 stopers having 1 in 30 rotation and an oversize air inlet hole to feed leg."—Madsen Red Lake, Ontario.

"Carbide bits used on special jobs where hard rock prevents completion of drilling cycle as scheduled."—Tennessee Copper Co., Ducktown.

"Increased use of carbide bits for rock drilling reduces drilling time and gives better progress for shafts or drifts."—Menominee Range iron mine.

"About half of the contracts are using carbide bits to good advantage. By mid-1951, 90% will be using them."—Minnesota underground iron mine.

"Now using 'G' carbide bits in certain parts of mine. Average consumption about 75 per month. They average 9-plus uses per bit and average 32 ft. per use, or 288 ft. per bit."—New Park Mining Co., Utah.

"Carbide bits work satisfactorily in some areas, drilling over 3500 ft. per bit. Choice of drillers evenly divided between 'F' and 'G' bits; depends largely on nature of ground; both bit manufacturers now recognizing necessity of having inserts of different hardness for different ground. See paper by Eugene Lillstrom, Mining Symposium, 1950, Duluth."—Cleveland-Cliffs Iron Co., Michigan.

"Different combinations of carbide detachable bits with different drills are being tested with some evidence of cost reduction. About 300 ft. per shank is being obtained."—Large gold mining company, Ontario.

"Tests continued with carbide detachable bits in fairly hard hornblende schist and in hard abrasive quartz. Softer grades of carbide were generally found more suitable. Encouraging results obtained with light jackhammers and airlegs and short-skirted detachable bits. Some 400,000 ft. drilled in two mines. Average life of bit about 150 ft. Limiting factor has been breakage at the skirt and breakage of rod mostly at tapered end, with occasional loss of bit."—John Taylor & Sons (India), Ltd. (Kolar gold field).

"In the first 10 months of 1950, drilled 430,377 ft. with 996 'G' bits (adopted in Nov., 1949), for average of 432.1 ft. per bit. Each bit is resharpened an average of 10.7 times."—American Zinc, Lead & Smelting Co., Metaline Falls, Wash.

"Advantage gained with insert bits in small 'bald headed' raises is that it is rarely necessary to change bits, difficult in cramped quarters. Miner checks bit condition before going up raise and can drill out without changing." — Highland Surprise Cons., Idaho.

"Using 'F' and 'G' carbide bits instead of plain carbon bits, in secondary drilling. Greatly improved results."—New York open-pit iron mine.

"All drilling with 'F' carbide bits."—Underground iron mine, New York.

"Now changing over three (underground) iron mines entirely to carbide bits."—Another New York operator.

"In hard chert and quartzite have used 'G' carbide bits and are going to try 'F' bits. These bits have been satisfactory, averaging 200 ft. of hole per bit at cost of 7.5c. per ft."—Park-Utah Cons., Utah.

"Started in August to use 'F' carbide bits. Four-point bits. Starters are 1⅜-in., on ⅞-in. Q.O. alloy-steel rods. Excellent results."—Wright-Hargreaves, Ontario.

"Carbide detachable bits are used in part of the holes drilled in a round, that is, only in the hard areas in a given face."—Pend Oreille, Washington.

Carbide Has Arrived

The foregoing varied comment, from many widely separated parts of the industry, surely indicates that carbide drilling has already become a well-established practice. Currently, manufacturers of detachable carbide bits include: Kennametal, Inc.; Ingersoll-Rand Co.; Joy Mfg. Co.; Timken Roller Bearing Co.; Rock Bit Sales & Service; Milford Tool Co.; Firth Sterling Steel Corp.; Holman Brothers; Rip Bits, Ltd.; Thomas Firth and John Brown; and the Swedish makers of Seco, Avesta and Dannamora bits.

New carbide bits include a 3-point rock bit for ravelly ground by Kennametal, Inc.

The Connection Between Bit and Rod. The thread now appears to be accepted by most drillers and manufacturers for connecting bit and rod. Thread profiles vary to avoid

interchangeability of bits. Other types of connection there are, some of them much used. The plain steel end which upsets into an undercut in the bit socket base holds well but can be hard to detach, in one expert's opinion. (Another opinion is that better mine shop practice will give a rod end more accurately made, which will help detachability.) He also points out that the tapered socket expansion principle works well under most circumstances but requires very close, accurate machining of the steel end and close forging or machining accuracy in the bit collar. The cam lock principle has been used with some success but is restricted in service. The twisted collar attachment, he says, is practical, holds well, and is not too difficult to detach but is not favored for multi-use steel bits or for carbide bits.

Other expert opinion holds that while the ideal solution would be to have one type of connection, this is a utopia never to be realized.

Exceptions there are in respect to the threaded connection. Powell Rouyn, at Noranda, testing insert bits, found that the threaded connection did not stand up on short holes. (Their quartz is also hard on the carbide, causing a big gage loss and breakage of inserts.) A Sudbury Basin producer maintains that no satisfactory connection has yet been developed that gives costs comparable to those it is getting with carbide-tipped forged alloy steel, using a chisel bit.

Carbide-Tipped Steel Avoids Connection Problem

Swedish Drilling Equipment in U. S. The problem of connecting bit to rod has been avoided by making the tipped bit integral with the rod. The story of the introduction to Canadian mining by Canadian Copco, Ltd. of Swedish steel of this type with light drills and airleg for setting up has been told (*E&MJ*, Feb., 1950, p. 111). Likewise much of the test work and operating experience has been described (*E&MJ*, Aug., 1949, p. 80; Nov., 1950, pp. 106-107; and Jan., 1951, pp. 88 and 89). The past year saw the organization of Copco Pacific, Ltd., in San Francisco (like Canadian Copco., Ltd., a subsidiary of Atlas Diesel Co. of Stockholm) and the opening of a Salt Lake office by Sandvik Steel, Inc., both for the introduction of carbide-tipped forged steel (Coromant), light drills and air legs (Atlas-Diesel) to Western users.

Previously the production and distribution of carbide-tipped steel had been undertaken by O. J. Black, Bishop, Calif. (*E&MJ*, August, 1949, p. 80; Dec., 1949, p. 88; June, 1950, p. 104); also by Rock Bit Sales and Service, Philadelphia (*E&MJ*, Jan., 1950, p. 82). A few mining companies also are making their own tipped steel.

Mr. Black, referred to, now uses a steel containing chromium and molybdenum and high in carbon. While harder to forge than the former steel, it gives longer service, has higher fatigue resistance. The inserts are also changed, being tougher with greater wear resistance. It is made in ⅞-in. size with 1½-in. bit and in 1-in. size with 1⅝-in. bit.

Users in Canada. The experience and test work of some dozen Canadian companies have been previously discussed (*E&MJ*, Jan., 1951, and other issues). The following may be added:

"Tests indicate savings in good drilling ground for use of tipped steel instead of detachable steel bits."—Large company in western Canada.

"About half the machine shifts are using tipped steel and light drills with success."—Perron Gold, Quebec.

"Experimental work with locally-tipped steel promises to reduce cost of carbide drilling."—Large company in northern Canada.

"Have driven 2,500 ft. of 7 x 7-ft. drifts and crosscuts with light drills, jacklegs, ⅞-in. hex. collared steel and chisel-type carbide bit. Labor cost improved per ft. advance with equal steel and powder costs. Runner finds it easier and faster."—Matachewan Cons., Ontario.

"No satisfactory connection yet developed to give costs as good as those obtained in drilling 25% of drill footage with Coromant ⅞-in. hex. alloy steel and carbide chisel bits."—Operator in Ontario.

"Using four light drills with airlegs in hard ground with carbide-tipped steel."—Large gold mining company, Canada.

"After extensive tests, have standardized on Coromant tipped steel, with Atlas Diesel machines and jacklegs for drifting and light Holman Silver Bullet stopers for raising. Have eliminated steel forging and tempering shop." — Granby Consolidated, British Columbia.

"Breaking half the ore with Atlas Diesel RH655W jackleg drills and carbide-tipped chisel-type steel. Chief savings in cleaning and picking benches before drilling and in ease of pulling steel and blowing holes clean." —Pamour Porcupine, Ontario.

"Have 41 light airleg-mounted drills using tipped steel at two operations. Cost per ft. with this equipment is 5.06c., compared with 9.25c. with old equipment."—Mine in northern Canada.

"Using Coromant and Hayes carbide-tipped steel."—Hasaga Gold, Ontario.

"Testing with 2⅝-in. jackleg drill and carbide-tipped chisel-type steel. Abrasion by hard ground wears bit quickly, each steel averaging 100-120 ft. Drilling cost per ft. high but greater tonnage broken per machine shift makes cost per ton slightly lower than when using steel bits."—Powell Rouyn, Noranda.

Tipped Steel Users Elsewhere. Companies other than those in the Birmingham district, Alabama, and the Bishop district, California, already mentioned, include the following, whose comment is also given:

"The Swedish equipment has increased production 20% with fewer men underground." (Average footage drilled per steel 400 ft., maximum 800 ft.) — Central Eureka Mining Co., California.

"Have a small-bore, pneumatic-leg drill of Swedish make and several sets of Swedish carbide-tipped forged alloy steel (starter size about 1¼ in.). Results indicate there is money to be saved. Not conclusive."—Sunshine Mining Co., Idaho.

"Carbide-tipped forged steel, of domestic make, formerly used rather extensively at Mather 'A' mine. Results inconclusive, due largely to apparent inability to get uniform quality of steel. Tests continuing at Cliffs Shaft and Athens mines."—Cleveland-Cliffs Iron Co., Michigan.

"Experimenting with Rock Bit Sales tipped steel. Looks promising." —Tennessee Copper Co., Ducktown.

"Carbide-tipped steel test progressing to our satisfaction. Currently using 1½-in. bits. Some 1¼-in. bits being made on ⅞-in. hex. steel, and ⅞-in. powder is being used."—Mountain Copper Co., California. (This company is making its own tipped steel.)

"Carbide-tipped integral steel, small diameter, has replaced threaded detachable bits."—Operator in Summit County, Colorado.

"The combination of airleg, light jackhammer and carbide-tipped drill rod has revolutionized mining in the Kolar gold field in India. Nearly 75% of the development at one mine is done with it and it is likely to be extended to stoping in the future. Recent tests with the carbide-tipped steel have shown an average rod life of 350 ft. Drilling cost has been reduced, and rod breakages have been few. Life of the rod having been found to be greater than that of the insert, experiments are under way to retip the rods locally with imported inserts."—J. K. Lindsay, managing director, John Taylor & Sons (India), Ltd.

"Since introduction of carbide-

tipped steel with chisel bit, drilling has improved. Now customary for two Africans using airleg jackhammer to drill two complete rounds per shift in 6x6-ft. headings in moderately hard ground. An average of 17 4½-ft. holes drilled per heading, or 153 ft. per machine shift. Superceded previous practice where two Africans, using car-mounted drifter, drilled one heading only per shift." — Rhokana Corp., Northern Rhodesia.

"Carbide-tipped steel has now entirely replaced conventional forged steel." — Roan Antelope, Northern Rhodesia.

"Several brands of carbide-tipped forged alloy steel have been used in test work with light Swedish jackhammers and pneumatic feed leg."— Large operator in Mexico.

"Using some Swedish steel having integral carbide-tips. About 90% of drilling is done with I.-R. Carset bits." —Chief Consolidated Mining Co., Utah.

Drilling with carbide-tipped jumpers on the Rand has doubled since last year.

The Smaller Drill Hole

Many operators are taking advantage of detachable carbide bits and drilling small holes full depth in order to secure faster drilling and contingent benefits. Noting this, an engineer for a company making bits points out that this may prove disadvantageous if carbide production is stopped or curtailed by Government restrictions on the use of tungsten and cobalt. The practice has required much development in drilling equipment, blasting powder and hollow steel. If stopped, these operators will have to return to using the multi-use detachable steel bit, drilling larger starting holes and using graduated bit sizes. The lighter equipment currently "fashionable" may not be equal to the task.

In contrast to this view, the engineer of another bit manufacturer holds that the small drill hole (1¼ in. to 1½ in.) has come to stay.

On its 850-ft. level where International Minerals & Chemical Corp. is mining langbeinite, at Carlsbad, the size of drill hole has been reduced from 1¾ in. to 1⅜ in.; former practice was to collar a hole 1¾ in. in diameter and finish it at 1½ in. diameter using three steel changes. The hole is now collared at 1⅜ in. and finished at 1¼ in., using three steel changes and 1/16-in. gage changes. This allows the same powder charges to fill the hole more nearly and gives better fragmentation. This small gage change between steel changes is made possible by using a bit that has a long tungsten-carbide insert running down the entire length of the prong. The long insert holds gage much better than the short one formerly used.

Cobalt and the Drilling of Long Holes

Long Holes With Carbide and Coupled Rods. Any curtailment in the supply of cobalt and tungsten available to insert makers will also curtail this method of drilling long holes. The drilling speed attainable and the reduced cost per foot of hole have made it attractive. Return to steel bits with coupled rods would mean slower drilling of larger holes and more frequent bit changes, and this, in turn, because of the inconveniences in restricted places, would cause operators to go back to previous practices.

The drilling of long holes with carbide and coupled rods has nevertheless been increasingly inviting trial. To date it has been moderately successful in replacing blast-hole diamond drills, but only where rock is hard, diamond cost (per foot drilled) high, and holes not more than 60 ft. deep. No less than 20 instances have been noted in our necessarily limited canvas of operators. Space limitations prevent full recital. The shoulder connection has not been successful in this application.

Howe Sound's Chelan Division, Washington, continues to drill holes in this way up to 70 ft. long with 2-in. carbide bits and automatic 4-in. drifters. Standard equipment includes 1⅛-in. round carbon steel. The management is experimenting with alloy steel of smaller section. East Malartic, in Quebec, has been using coupled rods and carbide bits in sublevel incline cut-and-fill stopes for holes up to 50 ft. and averaging 40 ft. since last May. For 10 months before, the work was done by an outside contractor. Most of the holes are up, inclined 50 to 55 deg. to the horizontal. An Eastern iron mine is having success with the method and expects to adopt it as standard at an adjacent property. Warren Foundry & Pipe Corp., New Jersey, now developing new stoping areas for sublevel work to replace shrinkage stopes, plans to use the same drilling method extensively as production increases. In South Africa, O'okiep Copper Co. is doing practically all of its long blast-hole drilling with coupled rods and carbide-tipped bits. The bit, however, consists of a 30-in. shank of 1-in. Q.O. alloy steel with a carbide-tipped bit forged on one end and a thread on the other to take the standard I-R Type 2 coupling. (Diamond drills are used by O'okiep for blast-hole work only for extra long holes involving difficult set-ups.)

Cleveland-Cliffs, at its Spies-Virgil mine on the Menominee Range, where a semi-hard ore is produced, is successfully using in the stoping system horizontal holes up to 60 ft. long, drilled with carbide bits and coupled rods. At its Mather "A" mine on the Marquette range, however, where it developed long-hole drilling with coupled rods, it is not using carbide bits extensively, because the steel bit is sufficient for most of the ore. In the softer ores, the 2½-in. bit is employed, with regrinds down to 2¼ in. Algoma Ores Properties, in Ontario, drills 75-ft. blast holes, carbide drilling appearing cheaper than diamond drilling.

Several other companies are using this drilling method to a limited extent or for special tasks. Two operators have not found it a complete success. Patiño, in Bolivia, has replaced it with block-caving during 1950, for both ore and waste fill, and A. S. & R. Co. in Mexico gave it up, after starting it early in 1950, but only because of excessive rod breakage at the couplings. Tennessee Copper expects to start experimental work early this year, and an Ontario company is in the first stage of an experiment using a 4-in. Leyner-type drill, 2-in. carbide bits and case-hardened 1⅛-in. x4-ft. rods. Results are excellent.

Drilling Aids Multiply

Setting Up Speeded. Use of jumbos and other mountings for rock drills to speed and ease the work of setting up is growing steadily. The boom- or mechanically-mounted drill has made a place for itself in American practice in primary openings, and the airleg is a boon to operators in secondary openings, such as scram drifts, rill or breast stopes. (At a Summit County mine, in Colorado, jumbos have been replaced by airlegs.)

Diversity as to design and size prevails respecting jumbos. Basically the track-mounted jumbo is not too complicated, according to expert opinion. However, variations in track gage, drifter feed lengths, the size and design of tunnels in construction work, and the evidence of trackless mining indicate that there is not sufficient demand for any one basic size or type to obtain any degree of standardization.

Equipment and procedure developed on the job is a feature of current practice. The "Coy Hobo," designed by H. A. Coy, manager for American Zinc Co. of Tennessee, at Mascot, by virtue of rugged, all-welded chains on four rubber-tired wheels and a 14-in. clearance underneath, climbs in stopes, readily negotiating grades of 15-20%. It mounts one Joy drill-jib boom swinging 360 deg., has two 15-hp. air engines. Jumbos at Mascot, in stopes where beds dip 6-20 deg., show 18% increase in production.

A Tri-State operator is using a jumbo with a 35-65-ft. telescopic mast for collaring a raise in a high back or taking down roof.

At a large gold mine in Ontario, a method of drilling flat holes with a stoper involving a scheme for supporting the drill, has been devised which obtains drilling speeds higher than can be had with jack-leg mountings. One man can handle the drill.

Cleveland-Cliffs finds that with the tire-mounted, two-drill Joy-Sullivan Drillmobile it can cut overall drilling time by 30%, including setting up and tearing down of post-mounted drills.

Howe Sound's Chelan Division, Washington, is making more use of 9-ft. feed jumbos. Two 7-ft. rounds per jumbo can be drilled where the working faces are not too far apart. Development is now laid out to turn this to maximum advantage.

Other improvements, actual and planned, include the adoption by a big company, in the Canadian North, of automatic line lubricators and a rock-drill lubricant containing a corrosion inhibitor. Day Mines, Idaho, is using pneumatic drill columns of aluminum tubing, especially for bench rounds and for sinking with drifters. Use elsewhere of aluminum alloy shells, strong as steel, for drills is also reported. Several drill manufacturers are cooperating with the Chief Consolidated company, Utah, for developing a good steel puller for "slick steel." Rock Bit Sales & Service is introducing a device for reclaiming lost bits and steel broken off in the drill hole in order to save the hole.

For driving its 10x10-ft. headings Granby Consolidated, Copper Mountain, B. C., has developed a drill carriage that supports three jackleg-mounted Atlas-Diesel drills. It consists of a platform on a standard carriage and has two side extension platforms. The latter, sliding on rollers, are extended for setting up and retracted for tearing down. Air and water manifolds are mounted underneath the platform. With this carriage and a Model 40 Eimco (see also p. 115), three men average a 7-ft. to 7½-ft. round in 8 hr.

For drilling the round in its new Central shaft, Tennessee Copper Co. developed a jumbo having four legs, adjustable for leveling (*M.E.*, Nov., 1950). Four drills were mounted on a 3½-in. pipe frame.

Blasting Improvements Getting More Attention

Use of Short-Period Delays Growing. Milli-second, or short-period, delay blasting caps continue to hold their position as the outstanding development in blasting in recent years. Opinion is general that they give better fragmentation, less shock, and save powder. The following excerpts are typical.

"Using milli-second delays in all stopes and long blast holes. Have increased tonnage broken per lb. of powder, improved fragmentation, eliminated missed holes, and improved back break."—Madsen Red Lake, Ontario.

"Short-period delays proving very satisfactory in stope blasting. Better fragmentation plus directional throwing of muck away from 65° footwall is being obtained."—Golden Manitou, Quebec.

"Experimenting with milli-second delays, or what is known as 'ripple blasting.' To date, results most encouraging. Anticipate this method will be made standard practice in such of our mines where it applies."—O'okiep Copper Co., South Africa.

"Milli-second delays used in stopes to give improved fragmentation and possibly less back-break and wall shattering."—Ontario mining company.

"Making increased use of short-period delays, finding cleaner break, less facturing of walls, better fragmentation, and almost no cut-off holes."—Pamour Porcupine, Ontario.

"Adopting fast delays for 96% of all stope blasting."—Large company in northern Canada.

"Milli-second delays coming into general use in stopes. Biggest blasting advance in years."—Negus Mines, Canada.

"Use of milli-second delays most satisfactory. Fragmentation improved, effect of concussion on hanging wall and along strike negligible. Primary blasting costs 25% below normal for EX stoping."—Rhokana Corporation, Northern Rhodesia.

"Blasting stoping rounds with milli-second delays has reduced secondary blasting."—Sidney Mining Co., Idaho.

"Short-period delays have entirely replaced detonating fuse and instantaneous caps for large blasts. Fragmentation improved, concussion reduced, powder saved."—Big Canadian company.

"Successful in some larger drifts and stopes."—Combined Metals, Nevada.

"Considerable blasting with short-period delays. Improved fragmentation in blocky loose ground, mostly in wide stopes; reduced concussion; less likelihood of missed holes."—Large gold mining company, Ontario.

Short-period delays were used successfully to enlarge shaft stations in New Jersey Zinc Co.'s Sterling shaft, Ogdensburg, N. J. They produced a clean break, satisfactory fragmentation and minimum concussion.

In blasting with short-period delays, Pamour Porcupine, Ontario, is finding the Beethoven dynamo-condenser exploder, sold by CIL, an ideal accessory. It is said to be a copy of an excellent exploder used by German engineers during the war, which Canadian engineers used in preference to their own.

Cleveland-Cliffs is experimenting with a small blasting machine which will handle 10 to 20 holes in parallel instead of in the conventional series blasting. They regard parallel blasting as much safer and easier to supervise.

Other Developments. International Minerals & Chem. Corp. is using pre-punched primer powder on both levels of its potash mine at Carlsbad, N. M. (This has a small tube in the stick, in which the cap is inserted at the face as drill holes are loaded.) Former practice was to make up primers in the magazine and carry them to the face. Plastic tamping rods are being substituted for the wooden rods formerly used to tamp the dynamite.

American Zinc Co. of Tennessee is using Carlon E.D. ¾-in. mine pipe, supplied by Micro Plastics, Ltd., Acton, Ont., for tamping powder in long horizontal and up holes. The tube has a wooden plug riveted on the end. For transporting it rolls up 3 ft. in diameter. In loading, it is stretched out in the drift and fed in and out of the hole, tamping two sticks at a time of 1⅛-in. gelatin powder. The tube is light, if anything, too light. The management regards it as the best tool for loading long holes it has found.

Consolidated Beattie, Duparquet, Que., is making considerable use of Thermalite igniter cord in raises and drifts. With it, they say, no blow-out, missed hole or instance of faulty timing has been experienced.

Howe Sound's Chelan Division, Washington, has adopted a lower velocity powder for primary ore

breaking, with resultant equal or better fragmentation. The management is also experimenting with the shaped charge for secondary fragmentation.

More general use is being made of bunch spitting in blasting with fuse by Day Mines, Idaho. Powder in 1x8-in. sticks is also being adopted for 1½-in. blast holes. Madsen Red Lake, Ontario, is also using 1-in. powder instead of 1⅛-in., due to drilling smaller holes. The same efficiency of break per stick is claimed, also a 30% cut in cost of explosives for stoping and a 15-20% saving in explosives for drifting and crosscutting. Perron Gold Mines claims to be using ⅞-in. powder instead of 1⅛-in. sticks previously used.

Use of Roof Bolting Grows

Means of Ground Support Varied. The practice of roof bolting is spreading rapidly, experimentation being under way by many companies. In the Birmingham district, roof bolting has largely supplanted other means of ground support in the iron ore and coal mines of the Tennessee Coal, Iron & Railroad Co. (*E&MJ*, Jan., 1950, p. 82; also July, 1950, p. 83; also Jan., 1951, pp. 58-61). The company announced in June that it had cleared all upright timber supports from 5 million square feet of its workings, giving more room to work in.

Use of roof bolting is being extended by U. S. Smelting R. & M. Co. to drifts, raises and stopes in the U. S. and Lark mine, Bingham, Utah. This method of roof or wall support is proving successful and to have wide application in preventing squeezing ground from breaking the timber installed in conjunction with roof bolts in steep raises and stopes. In its Mt. Hope iron mine in New Jersey, the Warren Foundry & Pipe Corp. is testing the applicability of roof bolting for supporting the hanging wall of narrow (8 to 12 ft.) shrinkage stopes. An Ontario operator is successfully using 6-ft. and 8-ft. bolts to support the hanging walls of flat shrinkage stopes where timbering is not practical. Sladen Malartic, Ontario, is employing 1¼-in. steel bolts for rock support, also 1⅛-in. cable where applicable along spans. Sidney Mining Co., Idaho, has used bolts to support the back in stations and hoistroom and to tie up hanging-wall slabs in shrinkage stopes. Combined Metals, at Pioche, Nevada, is currently experimenting with roof bolting to replace stulls and square sets for supporting ground in stoping areas. The practice shows promise for some of the less faulted areas. At one mine in Summit County, Colo., roof bolting has replaced much timber in a bedded deposit.

In a limestone mine in Pennsylvania, the main shaft is being "roof-bolted" from the 400- to the 720-ft. station. All timber, it is expected, will be eliminated for supporting the back. The management is much pleased.

The advent of roof bolting has stimulated a big demand for mine car compressors.

Interest Revives in Timber Treatment. High cost and growing scarcity of good mine timber has increased the industry's interest in preservative treatment. Some companies are treating their own timber, or part of it, for example, applying preservative only on the ends of posts and caps. Others are having it treated. Still others are buying timber already treated, as when Chief Consolidated, Utah, recently bought several carloads of pressure-treated Wolmanized timber. This will be used for specific jobs along main haulageways and in areas where timber decays rapidly. A custom timber-treating plant has been completed by Osmose Wood Preserving Co. of America, at Bessemer, Mich., on the Gogebic iron range. With it all mines on the range will be treating timber for use in permanent openings, either at this plant using Osmose salts or at their own plants using chromated zinc chloride. One company will be treating 1,500,000 bd. ft. per year.

Hecla Mining Co., Idaho, is trying copper naphthanate. This has been used for treating the timbers in a new substation and compressor room in the Silver Summit mine. Day Mines in same area is using Osmoplastic on the ends of posts and caps (and dipping all hemp ropes in copper naphthanate).

Park-Utah Consolidated Mines Co., Utah, has been using Wolmanized (Oregon fir) timber in its main tunnels, drifts and crosscuts. As yet it has found no deterioration due to dry rot, although the treated timber tends somewhat to become brittle and crack. Copper naphthanate preservative also has been used to some extent, being simply painted on the timber before installation. It seems to retard the growth of fungus. Timbers for a new shaft that the company will be starting soon are to be treated, after being framed, in a vat with Osmose salts for 24 hr. Park-Utah uses about 900,000 bd.ft. annually, about 80,000 bd.ft. of which is treated, chiefly with Wolman salts.

Steel and Concrete for Support. Use of steel and concrete for ground support is increasing. What can be done with concrete to support ground in slushing and haulage drifts is well demonstrated in the underground workings of the Bethlehem Cornwall Corp. in Pennsylvania ("Concreting Pays for Slushing and Haulage Drifts," Joseph Bernhardt, *E&MJ*, Dec., 1950, pp. 82-85).

At Howe Sound's Holden mine, in Washington, both steel sets and roof bolts were used extensively last year. Roof bolts in conjunction with a channel-iron cap have proved successful as temporary support in blast-hole drifts. Also proving successful is the use of roof bolts, metal lath, and gunite for ground support in slusher drifts where concussion is intense from secondary blasting.

Use of steel sets on both main level and sublevels in Cleveland-Cliffs Iron Co.'s mines is increasing rapidly. Where there is no particular weight, the conventional set is used. A new arched set of the company's own design is being used in 4-in. W.F. 13 lb. and 5-in. W.F. 16 lb., with inquiries out for some in 6-in. W.F. 15½ lb. Along this line the engineers are also working toward an economical method of concreting important block-caving transfer drifts, after accomplishing initial support with steel sets.

An iron mining company in northern New York has gone completely to steel support with cedar lagging for drifts and winzes. The drifts have two types of support: (1) A drift set made of 6-in. I's for caps and 4-in. H's for posts with angles to tie the sets together. (2) 6-in. I's for caps supported on pins and brackets on the walls. The winze set is made of 6-in. H's tied together with angles.

Hecla Mining Co., Idaho, has used Armco tunnel-liner plate to form a triple arch for support of roof in an underground compressor station. This proved cheaper in first cost and installation cost than the conventional method of lining with concrete.

A Southwestern copper company is currently experimenting with 3-piece, full-circle, 4-in. H section,

Bureau of Mines Information Circular 7583 on "Roof Bolting in the United States" appeared under date of September, 1950.

13-lb. steel drift sets for support in the grizzly (or draw) lines in the areas of heavy ground in place of standard timber sets. Overall maintenance cost is expected to show a saving. Since July, 450 ft. of drift has been timbered with these sets.

Trackless Loaders Multiply

Mechanized Mucking's High Point. In the last six months, the wraps, so to speak, were taken off the trackless mining operations of St. Joseph Lead Co., in Southeast Missouri, and those in the iron ore mines of the Tennessee Coal, Iron & Railroad Co. in the Birmingham district. *E&MJ* for January presented an account of the latter, involving the application of crawler-mounted loaders, rubber-tired shuttle cars, trackless self-propelled drill jumbos and accessory equipment to the mining of heavy, abrasive iron ore. The objective of the T. C. I. company's program is full mechanization of iron ore mining with trackless units.

Adoption of trackless methods and equipment in the metal and non-metal mining industry is expanding rapidly. The Joy company, whose equipment has had such a prominent part in this development, now has 192 crawler-mounted loaders and 280 rubber-tired shuttle cars engaged in mining iron ore, lead and zinc ore, and six nonmetallic minerals including salt, gypsum, limestone, potash, bauxite, and clay.

Such equipment is available for use in beds ranging from 35 in. up to 15 or 20 ft. in thickness.

The latest type of loader (17HR) is intended for mucking haulage drifts of large cross section and small bore tunnels. It is designed specifically as a "hard rock" loader for iron ore, copper ore, etc., and may be mounted on rubber tires or on crawlers. It also may be electric- or diesel-driven. It is smaller than the 18 HR used in the Tennessee company's ore mines, having only about half or a third of the latter's capacity.

Much interest is expressed in the 17 HR loader on the Marquette range where one of them is expected to be delivered soon to Mather B shaft of Cleveland-Cliffs. The latter company proposes to use with it a comparatively short conveyor flight attached to the drift back, either by roof bolts or by fastening to the steel sets.

Diesel-electric shuttle cars having higher tramming speed and greater horsepower are now available for carrying heavy loads (14 tons), both on the level and on grades up to 15%. This shuttle car is intended for long-range hauls.

American Zinc Co. of Tennessee, at Mascot, has a Joy 60 E-5 cable-reel shuttle car in use hauling 800 ft. Flight and conveyor chain difficulties have been overcome and a 25c. per ton saving in loading cost has been realized as compared to slusher loading. They plan to purchase two in 1951.

Granby Consolidated, in British Columbia, is said to have the first Model 40 Eimco loader delivered to a Canadian mine. With it and the drill jumbo mentioned elsewhere they are advancing 7 to 8 ft. per 8-hr. shift in a 10x11-ft. heading with a three-man crew.

The popular "mucking-machine drawpoint" method for handling muck is said to be losing ground at Consolidated Beattie, in Quebec, in favor of grizzles and car-loading chutes of special design. Installation costs are higher, but the grizzly method is said to be cheaper in the long run by as much as 15c. per ton handled.

In contrast, at Pamour Porcupine, in Ontario, there is said to be a trend toward mucking-machine loading from drawpoints. Two new stopes are being laid out for such loading entirely, each by a slightly different set-up of switches, crosscuts and turntables to establish some relative cost figures.

Two New Shaft Muckers. J. V. Grismer, superintendent of Callahan Consolidated Mines, Idaho, has developed an air-operated dipper-type shaft mucker, for a shaft length of not less than 12 ft., to work below and inside timbers where close timbering is required. The frame is attached to the cage bottom or to a timber set. The 8-cu.ft. dipper can be tipped at any angle.

A combination jumbo and slusher designed to speed sinking of a 45-deg. incline 5,000 ft. long and 65 sq.ft. in cross section was described in *E&MJ*, Dec., 1950, p. 87. It is said to require a 3-man crew.

Shaft mucking with a half-yard clamshell hung from two hoists at the collar was done by Tennessee Copper Co. in its concrete-lined circular Central shaft for 900 ft. of the first 1,400-ft. lift. The hoists were then shifted to a station 750 ft. below the collar to finish the job. The mucking crew included one foreman, two clamshell control men, one clamshell hoist man, and one sinking hoist man.

The Riddell shaft mucker continues to be the most popular means of mucking vertical shafts mechanically. It has served in sinking more than 60 shafts, under a great variety of conditions, in 13 states and five foreign countries. Its use has minimized unit shaft-sinking costs and increased the sinking rate.

Slusher Horsepower Rising

Trend Toward Larger Scrapers. Currently at Cleveland-Cliff's Mather mine 125-hp. Sullivan hoists are in use with 60-in. and 72-in. scrapers. At Mather B, 125- to 150-hp. hoists are indicated, with scrapers up to 84 in. wide, for skip-loading trench service. A New York State iron mine has installed a few 100-hp. slusher hoists in place of 50-hp. units in scram drifts.

In a mine in northern Canada, Gardner Denver HME double-drum scrapers with 11.5-hp. air motors are replacing loaders in short sublevel drifts. It is easier to move the former into less accessible headings. Track also can be dispensed with.

Triumph Mining Co., Idaho, is using trench scraping for loading sticky ore into a measuring pocket for 2-ton skips in a vertical shaft. I-R double-drum tuggers are used.

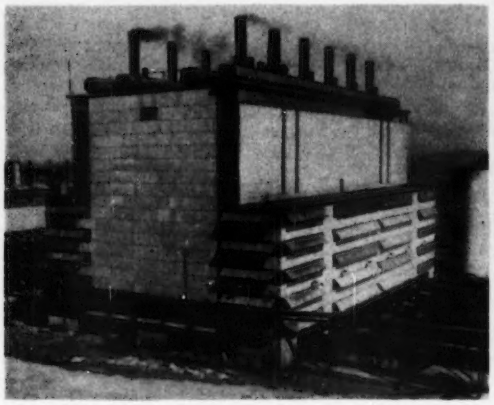
An Ontario company is using mucking machines to clean up development raise muck formerly handled by building chutes.

A New Jersey iron mine is cutting maintenance cost of stope chutes and getting longer life by building them of steel.

Use of Diesel Haulage Is Increasing

More Diesel Equipment Underground. Introduction of diesel mine locomotives into underground mines in the United States proceeds slowly. Some five units appear to be in service (*E&MJ*, May, 1950, p. 102; also July, 1950, pp. 82, 83, and 126). A sixth is known to be in operation for testing in a copper mine. All are provided with exhaust gas conditioners and in each case the mine ventilation is reported to be good. Three locomotive manufacturers have applied to the Bureau of Mines for approval of their locomotive. Such approval does not seem to be necessary at present. Manufacturers of diesel locomotives in Great Britain have evinced interest in the U. S. market.

This summary of current mining practice will be concluded in the March issue.



OLD METHODS, in new dress, are typified by Nicaro Nickel's leaching plant, to be reactivated this year. This is roaster house. Leaching's usefulness is growing fast.

NEW IDEAS include use of 48-in. DorrClones as high-capacity deslimers for phosphate rock, saving 22.7 acres of thickener area. This opens important field for cyclones.

Revived Processes Challenge Flotation's Thirty-Year Rule

R. H. RAMSEY, Executive Editor

BECAUSE 1950, the Mid-Century year, is an easy date to remember, it will be easy to recall in the future when it was that flotation first began to lose its pre-eminence as a mineral dressing process.

I hope this will not be misinterpreted as a statement that flotation is through. Far from it. But think back over the last 30 years of progress in milling. Flotation has dominated nearly every meeting of mill men, occupied the major part of their research and their ambitions. Flotation has been for three decades the star process of mineral beneficiation, the glamour method that achieved the most outstanding results and captured our imaginations without a fight.

Leaching Re-examined

The signs are unmistakable that our imaginations are free once more. Flotation is, as it always will be, an extremely useful tool for mineral dressing, but mill men are beginning to realize that there are other ways, perhaps less expensive ways, of coaxing value from gangue. Take leaching, for example.

If one could plot a curve of interest in hydrometallurgy (excluding cyanidation for a moment), the biggest sag in the curve would probably coincide with the greatest rise in the curve of interest in flotation. Now the hydrometallurgy curve is again on the rise.

One large copper sulphide orebody, for example, faced a hopeless future when it was thought that the cost of grinding and floating by conventional methods would be prohibitive. A partial solution to the problem was found in using a bulk float to recover all sulphides, then grinding only this concentrate to the point of liberation. Copper and iron could then be separated by flotation, or the bulk concentrate could be roasted and leached. It appears, however, that a newly discovered technique of ammonia leaching makes it possible to dissolve chalcocite effectively and economically. There need be no fine grinding and no flotation if the process, now being tested, works.

Leaching could, of course, be the answer to handling all manner of oxidized ores, including the silicates of copper and zinc. Leaching is even being considered for iron ores, as is mentioned in Mr. Roe's review of iron ore beneficiation in this issue. Leaching processes have long been known for oxidized lead ores, but they have never been developed partly because of the availability and greater attraction of flotation.

Tin ores, as Professor Gaudin has demonstrated (*E&MJ*, Vol. 146 and 145), can be floated, but it now appears that the greatest promise of handling such ores as the poorer Bolivian ores lies in roasting and leaching. Fink and Strauss suggested in *E&MJ* for December, 1950, a method of reduction roasting and alkali leaching of tin ores, and other similar methods are under investigation.

A Tax Problem

Use of leaching opens the possibility of producing a final commercial product, such as zinc pigment, directly from the ore in one sweeping operation. But before anyone builds such a plant, he ought to weigh this factor along with all the others. If a mining company produces an oxide from its ore, and not a metal, it will lose the depletion allowance ordinarily granted to miners of that metal. That is, if you make zinc oxide out of your ore, you'll get no depletion. Your neighbor over the hill, who sticks to making metal, will get the depletion allowance.

Research Needed

Obviously, it is impossible to reduce all the foregoing to a simple statement like "Flotation is out, leaching is in." But there is plenty of evidence to indicate that the scope of mineral dressing techniques is widening rapidly. The industry needs more research and needs it badly. It needs more managements like one we know of that is willing to spend liberally for research.

Unfortunately, we cannot mention the name, but it is worth taking a quick look at the research now going on at "X" Mining Co.

Handling only about a tenth of the tonnage of a "big" mine, X has these programs going: improving the design of both mechanical and air flotation machines; study of rod mill liners; fundamental chemistry of flotation as applied to the local ores; use of spectrophotometer for rapid analysis of pulps; reduction of corrosion in ball mills; reduction of grinding costs; improved classification methods; reduction of general milling cost through better materials handling and automatic controls.

If all the larger mining companies had research budgets in proportion to X's, the milling business would begin to get answers instead of questions. And, more important, the nation would get more of its needed raw materials more economically.

Crushing

Use of a hammermill type of crusher in a metal mine aroused considerable interest last year. The new Reeves-MacDonald concentrator of Pend Oreille Mines & Metals Co. uses a 30x30-in. Cedarapids dual-impact breaker. (*E&MJ* Jan., 1951.) Because the rock is not extremely hard or abrasive, the crusher does very well. As a secondary crusher, it handles 175 tons per hr. to minus 1½-in. Power requirement is 100 hp. The new Golden Cycle mill at Cripple Creek uses the same type of crusher. Tests at another mine with a hammermill on a more abrasive ore some time ago did not work out so well. The hammers wore off too fast.

Screening

Dramatic results are reported with a new idea for keeping vibrating screens from blinding. The method is simply to heat the screen cloth as a toaster is heated by passing a current through it. The heated wires are noticeably more resistant to blinding than in the same cloth, unheated. This could greatly increase screen life, because any other method thus far worked out to prevent blinding is also very hard on screen cloth.

Nordberg has a new type of vibrating screen in which the screen cloth is arranged in a vertical cylinder. The screen rotates about its vertical axis and oscillates at the same time so that the screen cloth follows a serpentine path as it revolves. Tests indicate high capacity and low wear on screen cloth.

Grinding

With defense production demands looming in the distance, the emphasis from here on in grinding will probably be to get maximum tonnage through the mill. That means high speed, high ball charge, coarser grind if possible, and more rapid wear of steel. It will probably also greatly hamper current efforts to find out exactly what does go on in a ball mill. The most fertile field for ideas so far is Tennessee Copper's huge Tricone ball mill, which is steadfastly being run in a way to yield information as well as tonnage. Why couldn't some larger mining company set aside a ball mill or two for a similar purpose, where the obligation to get maximum capacity was not so pressing?

B. S. Crocker, of Lake Shore, read an interesting paper at the Salt Lake meeting of the American Mining Congress. Tests at Lake Shore showed that ball mill capacity varied pretty much as specific gravity of grinding medium. The staff wanted to use ore fragments as the medium, but found they'd have to accept a 66% capacity reduction, other things being equal. Actually, capacity was maintained by increasing the diameter of the ball mills. Low discharge pebble mills were found to have 40% more capacity than high discharge pebble mills.

Minus 3-in., plus 2-in. pebbles are screened out of the ore at surface and are fed to the mills as carefully as steel balls. Pebble consumption is 2.2% of daily tonnage. At a price of $118 per ton for grinding balls, Lake Shore saved $0.25 per ton milled, or $92,500 per year.

Also at Salt Lake City, four papers on liners brought out the fact that rod mill liner wear is greatly accelerated by poorly-fitted liner bolts. Liner plates should also be carefully fitted. Probably the best bet is to have no bolts at all, and hold the liner plates in with zinc. Tennessee Copper uses zinc and has experimented with Pozzolith-treated cement (it makes a denser concrete) and some kind of plastic. The plastic has the advantage that it resists acid water.

Tennessee Copper has tried a new liner plate in a rod mill that consists of a simple 3-in. groove lengthwise along the middle of the plate. The rods themselves then act as lifter bars.

Speaking of liners and the Lake Shore pebble mills together, suggests a use for some of the coarser ore that comes into the Eagle-Picher Central Mill in the Tri-State. It is well known that the Tri-State ore is harder and more abrasive than any one of a number of interesting but unrelated things, to which it is frequently compared. Why couldn't Eagle-Picher screen out coarse ore, as Lake Shore does, and sell it to other lead-zinc mills for grinding medium or mill liner?

Another example of ore grinding itself is the Aerofall mill, used more extensively in Canada than the United States, and principally for non-metallic minerals. Operated dry, the mill crushes and grinds in one step.

Where dry material must be ground to a fine size, the Fluid Energy mill made by C. H. Wheeler in Philadelphia is worth investigating. Here the material grinds itself in a whirling blast of air in a roughly circular chamber. Material to be leached, for example, could be ground to an extremely fine size, and the resulting leaching reaction ought to be almost instantaneous. Or a dry ore could be ground in a reducing or an oxidizing atmosphere, as desired. Very little work has been done with this device in the metal field, but it is well known in non-metallics and in pigments.

Classification

An interesting practice is that of the new Pend Oreille Mines & Metals Co. mill near Metaline Falls, Wash. (See *E&MJ* Report, p. 134.) To avoid sliming galena, the flotation feed is given a fairly coarse grind, then put through the lead roughers. Lead rougher tails are then reground before going to the zinc roughers. The avoidance of slimed galena was also the objective of Bunker Hill's flash grind, described in *E&MJ* for January, 1950.

For ores carrying high percentages of sulphides, the Dorr Co.'s

Hydroscillator should prove interesting. Under test for months at Tennessee Copper, the classifier is particularly easy to control. Sand load can be varied without changing overflow dilution. The action of the oscillating chamber puts gangue into the overflow at a coarser size and sends the sulphides to the mill for grinding. Usually there is less than 3% minus 200 mesh in the sand product.

Use of cyclones of the Dutch State Mines type for thickening is on the increase. The largest such installation is the American Cyanamid Co.'s phosphate rock plant in Florida, where ten 4-ft. cyclones are used to deslime at 150 mesh, the minus 1/32-in. material in the plant feed of 400 yd. per hr. The DSM cyclone is licensed for all uses other than heavy-media separation to the Dorr Co., which refers to it as the DorrClone.

Heavy-Media Separation

Wemco's Mobil-Mill is working out quite well in the Illinois-Kentucky fluorspar field. Crystal Fluorspar, for example, treats 25 tons per hour in a Mobil-Mill with a 7-ft. cone. On one ore, high in lead and zinc, the company puts through the ore at a cone gravity of 2.7, which cuts out calcite and silica. They raise the cone gravity to 3.5 and run the sink product back through, which recovers the fluorspar as the float and the lead and zinc as the sink. The heavy-media plant replaces an old jig mill at a considerable saving in manpower and at a higher recovery.

The widest application of heavy-media in this country is in iron ore beneficiation (see p. 119), but in Africa this year, the largest HMS plant in the world began recovering diamonds. (*E&MJ*, Sept., 1950.) Separation of diamonds from gangue called for extremely close control of the cone gravity, which has to be held at 2.90 top and 3.05 bottom of the cone. The new plant, at Premier Diamond Mines, treats 12,800 tons daily.

Flotation

The idea of effective volume in flotation machines is arising again, but in somewhat different dress. From points as widely separated as Montana, Arizona, and Laurel Hill, N. Y., come reports of investigations to see why it is that flotation takes so much longer in some machines than in others, or in plant-size cells than in lab-size cells.

A facile answer would be, of course, that the much more frequent passes of the pulp through the impeller in a lab cell provide a higher rate of aeration than most plant-size cells can match. But there is more to it than that. Nat Arbiter is working up some painstaking calculations on the rate of flotation that should throw light on the relationships of power applied, aeration, and cell construction.

At first glance, rate of flotation for any given ore and set of reagents would seem to be a function of power and intensity, but once again one comes back to the question of how wastefully, or effectively, the power is applied.

Greater Butte Ore

Difficulties in handling the oxidized ore from the upper workings of the Greater Butte project were described by F. F. Frick at the Salt Lake AMC meeting. Desliming and scouring of the ore is the first step; scouring to be done in Silex-lined mills with sulphuric acid added, and desliming to be done in drag classifiers. Sponge iron precipitates the copper from the slimes, and Minerec floats the precipitated copper. An excess of sponge iron must be added to prevent re-solution of copper. The sands and the ore from the lower levels (amounting to about 100,000,000 tons) will get a conventional lime-xanthate treatment.

Problems Ahead

The outlook for mineral dressing, as for all the mining industry, is a grim one. There has never been a time when the products of this country's mills had greater importance. The first job of mill men for the coming year is, therefore, to keep going and at top capacity. Here are some points to look for:

Manpower is sure to be a problem this year or next. It would seem worthwhile to begin now to work out plans to bring women in as mill operators. Women operators worked out so well at Castle Dome, for example, that a few are still there from the last war. See *E&MJ*, Jan., 1951, for suggestions on making use of the excellent abilities of women as mill operators.

All-out capacity won't be easy to hold over the long pull unless all equipment is in first class shape right now.

Maintenance will be a problem unless you have a well-organized routine worked out to handle it. There can be nothing slip-shod about maintenance in the months ahead, not if you expect to keep running.

Materials handling in an up-to-date manner can save a lot of manhours. Every mill man our staff has called on lately, who has tried out a lift truck, swears by them. There is always something around the mill or the surface plant generally for a lift truck to do. Rods, balls, reagents, crusher parts, timber, lumber, trash, concentrate, almost anything can be moved more easily, and more cheaply with a truck than by hand.

Quality control is coming some day. It is the business-like way to run a mill, and sooner or later you'll be using it. We'll explain what we mean in subsequent issues.

It seems apparent that mills need right now better and faster **means of measuring** accurately various mill conditions. Automatic controls are the second step, and there is no point taking it until the first is completed. Instrument companies could help greatly in supplying means for this measurement, if they would. Some more fortunate operators can do it themselves, as Carl Marquardt has done. (*E&MJ*, January, 1951.)

Oxidized ores still constitute a major problem, but the solution to it seems much nearer. Leaching, or a combination of leaching and flotation, as in the Greater Butte Project, show great promise.

Grinding needs more study, and it ought to be applied on a cooperative basis by several companies, which would pool their information and resources on the grand scale. But neither Kick nor Rittinger need enter the conversation, at least for a couple of years.

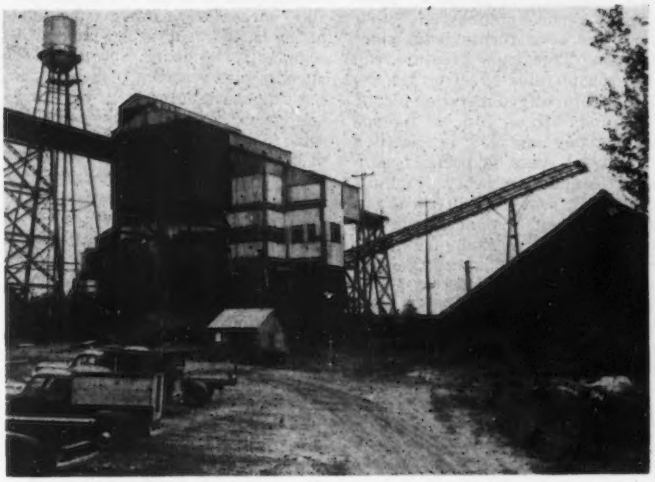
Don't count flotation out, by any means. It has tremendous jobs still to do. But it would do them better with more efficient designs of machines and with cheaper reagents. The competition in this respect, always keen, will sharpen.

Lastly, **the major problem** is how to get mining companies generally to spend more on research? There is plenty of money that could be used for it, either from private funds or from Government, but it isn't being spent. Milling stands in sorry contrast with the chemical and the petroleum industries in this respect. Although research in milling has come a long way these past few years, there is a long way yet to go.

Huge Expansion in Prospect For Iron Ore Beneficiation

Producing over eight times the tonnage of concentrate handled by domestic copper mines, iron ore milling plants are preparing to treat even greater tonnages.

L. A. ROE, Technical Supervisor, Ore Research Division, Jones & Laughlin Steel Corporation, Negaunee, Mich.



SHIFT TO MORE COMPLEX treatment is typified by this former washing plant at Interstate's Hill-Annex mine, which now houses a Heavy-Media plant.

ABOUT 70 IRON ORE beneficiation plants are now operating in the United States. These plants currently process about one-fourth of the country's total shipments of iron ore. If agglomeration plants are included in the total, then one-third of all U. S. iron ore is beneficiated before entering the blast furnaces.

Perhaps the most significant aspect of these figures, at least to mineral dressing engineers outside the iron ore field, is the tonnage of concentrates handled. The domestic copper industry may handle a total of 3,000,000 long tons of concentrates a year, but the iron ore industry is now handling about 25,000,000 tons of concentrates.

As the nation becomes more dependent on finer-grained ores and more complex treatment processes, the problems of materials handling will increase in line with the tonnage handled. This problem of materials handling is even now an inviting one. Last fall (Oct., 1950, p. 73), *Factory Management & Maintenance* (McGraw-Hill) asked a group of executives to "take a look into the future." Iron ore beneficiation engineers, and indeed all millmen, might well echo the forecast of Cloud Wampler, president of Carrier Corporation. He said, "If I had just one choice as to technological improvements that could be adopted practically overnight to boost productivity, I'd take materials handling. This isn't something you have to spend 15 years developing to get a wonderful result. It's there waiting for you now."

Despite recent discovery of foreign iron ore bonanzas, military necessity alone dictates that methods be developed to derive usable concentrates from domestic low-grade material, such as taconite. The past decade saw the real beginning of an iron ore beneficiation program in the United States. Laboratories were built and equipped, pilot plants set up, and millions of dollars were earmarked to build treatment plants for intermediate ore and to agglomerate flue dust and ore fines.

Now as the 1950-1960 decade opens, there are as yet no operating commercial taconite plants in the country. However, the scale of the forthcoming taconite plants is well exemplified by the Benson iron mine in upstate New York. Here 3,000,000 tons of crude ore per year is processed in a magnetic separation plant to produce 1,000,000 tons of high-grade concentrate. Most of it is sintered at the mine. Construction will begin this year on additional agglomeration units and a new plant, using Humphreys spirals, to concentrate martite-magnetite ore mixtures.

In September, it was announced that Republic Steel Corp. and Armco Steel Corp. had acquired, in equal shares, the ownership of Reserve Mining Co. This gives them control of a vast deposit of magnetic taconite on the east end of the Mesabi Range in Minnesota. It is said to contain 1½ billion tons. Reserve has announced that a large pilot plant will be built at Babbitt, Minn., as the first step in a $160-million development program.

The shortage of native sulphur will have considerable effect on iron ore beneficiation in the future. The latest estimate of domestic reserves of natural sulphur indicates a 25-year supply. The U. S. has furnished sulphur to foreign consumers cheaper than they could produce it from local materials, but the National Production Authority is preparing to cut back exports of sulphur this year.

The quest for sulphur is having an immediate reaction on the iron ore industry. Domestic pyrite deposits could supply more iron units for the nation's furnaces as well as provide sulphur compounds. It is interesting to note that between 1900 and 1948, pyrite contributed more sulphur for world consumption than did native sulphur deposits. In the U. S. during 1949, nearly 600,000 tons of by-product iron ore was produced from iron sulphides. During the same period,

over 200,000 tons of by-product sulphur was recovered from various sulphide ores.

Pyrite, heretofore wasted in many operations, will increase in value as reserves of iron and sulphur are depleted. Pyramiding air pollution laws are beginning to force agglomerating-plant operators to remove sulphur and other stack gas constituents from plant effluents. This legal pressure will have considerable effect on the design of future agglomeration plants.

Noranda Mines, Ltd., of Canada has actively engaged in research for several years to perfect methods of sulphur recovery from pyrite. U. S. Patent 2,530,630 is one of the recent announcements of their progress. As explained in this patent, the pyrite is nodulized or pelletized before ignition on a conventional sintering machine. The gases from the machine are cooled sufficiently to condense elemental sulphur from a portion of the gas flow. Part of the remaining gases are mixed with air and recycled to the sinter machine to properly control the burning reactions.

Heavy-Media Separation

New Heavy-Media separation plants accounted for most of the iron ore concentration plant expansion on the Mesabi Range in 1950. There are now 17 such iron ore processing plants in the United States with more to come. The first commercial HMS plant in Michigan completed a full season of operation during 1950. This plant, operated by Zontelli Brothers, is located at Ironwood, Mich., and has been treating material from dumps near the Pabst mine.

As former washing-plant operators become more familiar with their HMS plants, there arises much "constructive discontent." This leads to experiment and a continuous line of progress. One notable example is the rapid development of more efficient separatory vessels. Cone-type vessels are rapidly disappearing and will probably be museum pieces in a short time.

Considerable experimentation is under way to adapt separatory vessels to middling removal. This feature will become of greater importance as the size of the feed is increased. When coarser material is treated, there is usually a corresponding increase in the quantity of middling product. This makes it necessary to remove this product from the separatory vessel, crush it and reprocess in either a Heavy-Media separator or other gravity separation equipment.

New developments in the field of screening are being closely watched by HMS plant operators. One need only to visit a plant on repair day to understand the reason. Screen maintenance is one of the more costly items. Some of the newer alloy screen materials are helping in the battle of abrasion, but much remains to be done. The new Symons gyratory screen, which is attracting much interest in the sand and gravel industry, may provide some of the answers to the problem of increasing screen life. According to Nordberg, the manufacturer, whenever the particles and the cloth are in contact, they are moving in the same direction, thus decreasing screen wear. Several screens are in commercial operation using 10-mesh cloth.

Operators on the Mesabi Range have a local source of ferrosilicon medium in the recently established Rhude Media Co. of Marble, Minn.

The problem of medium loss has been given much attention. Plants operating on iron ores report losses of from 1 to 2 lb. per ton of feed. Some of the very porous, spongy-type ores present a real problem in washing to remove the medium entrapped in pores on the surface of the particles of both the sink and the float products.

Radio-active Tracers

Several suggestions have been made as to how to trace medium losses in plant operation. One of these which fits our atomic age is to add radioactive tracers to the ferrosilicon and use Geiger counters to trace losses in the circuit. Another problem arising from the study of ferrosilicon losses is to determine accurately the percentage of ferrosilicon and magnetite in the material removed from Heavy-Media plant products.

In Heavy-Media operations, fine-sized particles of magnetite are concentrated along with ferrosilicon as the medium passes through the magnetic separators. Practically all hematite ores have traces of magnetite associated with them. Magnetic materials can be quickly removed from a sample by passing it through a laboratory Davis-tube magnetic separator.

Rapid, accurate determination of how much of the magnetic fraction is ferrosilicon is more difficult. Grain counts can be used but are slow. One iron ore research laboratory is using an oxidizing-roast method to render the magnetite non-magnetic; then the roasted sample is reprocessed through the magnetic separator, and only the ferrosilicon is recovered as a magnetic product.

Gravity Concentration

Jigs are finding increased use in processing those fractions of HMS plant feeds which are too fine for economical concentration by Heavy-Media and are not amenable to the abrasion grinding-spirals method.

The Dutch State Mines cyclone has been giving some good results in laboratory and pilot-plant tests. No commercial installations have appeared in the iron-ore field.

Humphreys spiral plants are increasing in number and improving in efficiency. The problem of spiral abrasion (causing deep channels in the castings) is being vigorously attacked and several solutions seem imminent.

Flotation

Flotation continued in its Rip Van Winkle role, lying dormant as far as commercial iron ore beneficiation plants were concerned.

It is interesting to note a flotation report from the University of Stockholm on the influence of the presence of certain solids on flotation. The general conclusion was that the presence of solids in a given pulp may have a stronger effect on flotation than the presence of their ions, which may be consumed relatively rapidly.

In the amine flotation of silica from iron ores, it has been noted that certain minerals poison the float. The presence of as little as 5% of siliceous siderite, a mineral component of some Mesabi Range ores, can seriously affect the selectivity of the quartz float.

Some typical flotation results on various Lake Superior ores were compiled by F. D. DeVaney for presentation to the Eleventh Annual Mining Symposium of the University of Minnesota in Duluth last year. These results showed that good concentrates could be produced with iron recoveries ranging from 69.6 to 89.3%.

Apparently the chief obstacle in the way of large-scale adoption of flotation methods in beneficiating iron ores is still the lack of an efficient agglomeration method.

Agglomeration

The agglomeration of iron ores continues in number one importance in laboratory and pilot-plant test work. Various organizations

are investigating sintering, nodulizing, pelletizing and briquetting in efforts to solve one or more of the many problems involved in iron-ore agglomeration. Sinter plant capacity in this country will soon approach the thirty-million-ton mark. Several new sinter plants are under construction at the present time and more are planned. Some of the new plants are incorporating improvements which should improve efficiency considerably. Those features attracting most attention in the design of new plants are:

1. Close grading of raw materials.
2. Proper bedding of feed to sinter machines.
3. Layered fuel.
4. Air cooling.
5. Adequate sizing of sinter to provide uniform returns.
6. Dust control.

A new process for the disposal of waste iron sulphate-sulphuric acid mixtures should be of interest to advocates of the sintering process. This process, announced by The Chemical Construction Corp., consists of the sintering of extruded pellets made from a mixture of iron oxide, ferrous sulphate and coal. A semi-commercial plant is installed at Piney River, Va., to process 50 tons of liquor per day. The waste liquor contains about 12% H_2SO_4, 20% $FeSO_4$, and the remainder water. The liquor is filtered and the iron sulphate mixed with about 12% of coal and a quantity of crushed iron oxide obtained from returned sinter fines.

The mix is extruded to produce ¼-in. diameter pellets about ¼ to ½ in. long. The pellets are dried and then ignited. The coal in the pellets supplies heat to decompose the ferrous sulphate into sulphur dioxide and iron oxide. The sintering machine wind box is divided into two sections. Gases averaging about 7½% SO_2 are obtained from one section and sent to a contact sulphuric acid plant. The other section produces gases containing less than 0.1% of SO_2. These gases are used for drying the pellets and then discarded.

Research in the sintering field includes attempts to produce sinter with a larger proportion of iron in the form of Fe_2O_3 for better reducibility in the blast furnace. Swedish practice is to use a smaller proportion of fuel in the sinter mix and produce sinter containing 98% or better in the form of Fe_2O_3, although the starting ore is magnetite, Fe_3O_4. By American standards, most Swedish-type sinters have poor physical characteristics and are quite friable. Since American blast furnace operators want a "hard" sinter, a higher proportion of fuel is added, thus resulting in a less oxidized sinter.

Taconite Pellets Wanted

While the sinter process is being steadily improved in relation to treating fine-sized ores, the advancements are coming too slowly to allow potential taconite processors to rely only on this method. Consequently there is much interest in pelletizing and other methods.

The Allis-Chalmers Manufacturing Co. has announced a process for heat hardening iron-ore pellets which is being developed by Dr. Lellop, inventor of the famed Lepol kiln, which is becoming increasingly popular among cement manufacturers. The Allis-Chalmers method consists of making pellets (containing added fuel) in conventional balling drums and placing these pellets on a moving-grate sintering machine where the pellets go through the following stages:

1. Drying zone at 500° F.
2. Preheating zone at 1,000° F.
3. Ignition zone at 2,300° F.
4. Burning zone.
5. Cooling zone.
6. Discharge of hardened pellets.

Heat economies are effected by collecting preheated air from the burning and cooling zones of the sintering machine for use in the drying, preheating and ignition steps. The method has been tried only in batch tests, but it offers another attack on the problem of agglomeration of iron ores.

Oliver Iron Mining Co. has a new agglomeration plant near completion at Virginia, Minn. The plant is located near the Rouchleau ore crushing and screening plant. The installation includes a conventional sintering machine as well as a large nodulizing kiln. The latter has a 12-ft. diameter and is 350 ft. long. The new plant marks the first combination sintering and nodulizing plant on the Mesabi Range. Capacity is expected to approach 1,000,000 tons per year.

There are now five pelletizing furnaces set up for agglomeration testwork. These are located at:

Mines Experiment Station, University of Minnesota.

Erie Mining Co., Aurora, Minn.

Reserve Mining Co., Ashland, Ky.

Bethlehem Steel Co., Lebanon, Pa.

Cleveland-Cliffs Iron Co., Ishpeming, Mich.

The balling step of the pelletizing operation is coming in for additional attention. The University of Minnesota has accumulated a wealth of data relating to this step of the process, but so far it is impossible to predict the "susceptibility-to-balling" from ore characteristics and size analyses. Actual balling tests must be made to determine amenability. Allis-Chalmers is supporting a fellowship at the University of Minnesota which was established "to determine the strength variations in iron concentrate pellets under high temperature conditions."

In the November, 1950, issue of this journal, Prof. E. W. Davis gave the latest estimates of the cost per ton of pellets from taconite. These figures give an estimate of $9.24 per gross ton of pellets containing 64% iron (dry analysis) as to the total cost delivered to Lower Lake Ports. This allows a profit of $0.29 per gross ton. The current round of wage increases and the recent increase in the price of iron ore will probably balance out and maintain this estimated profit figure.

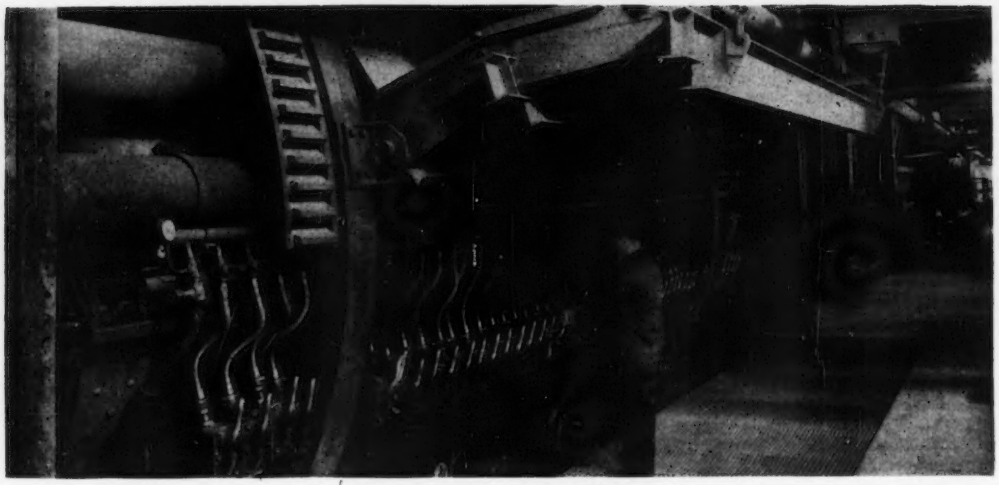
Chemical Methods

Chemical beneficiation of iron ores is attracting steadily increasing interest in the research laboratories. One range laboratory reports some interesting results obtained by caustic-leaching of silica from ores and concentrates. The amorphous silicate minerals are apparently more susceptible to this treatment than the crystalline silicates.

One university research engineer is attempting the acid-solution of iron from low-grade hematite ores and finding many interesting applications.

U. S. Patent 2,530,391 to Inland Steel Co. reveals a method of reducing the silica content of an iron concentrate to 0.5% or less. The process involves contacting the concentrate with boron trifluoride at 600° F., separating the resulting mixture of silicon tetrafluoride and boron oxyfluoride, and reacting this mixture with molten boric oxide at 1,470° F. to recover boron trifluoride for re-use in the process.

These chemical methods all sound far-fetched, but the trend of much research on copper, nickel titanium, and other ores is steadily in this direction. Even though these chemical methods are all far from commercial application, they are foundation stones in the ore beneficiation buildings of the future.



PRODUCTION OF THIS CONVERTER at McGill smelter has been increased 20% by using pneumatic tuyere punchers. Manual punching, an unpleasant task, has been eliminated and the man released for other work.

In Metallurgy, the Accent Is on New Metals, New Methods

A. W. SCHLECHTEN and H. R. HANLEY, Department of Metallurgy, Missouri School of Mines and Metallurgy

A SURVEY of the developments in the metallurgical industries for the brief period of one year uncovers many small changes. Whether these changes are improvements or merely temporary deviations from orthodox methods can be determined only in the course of time. The extractive metallurgy of the common metals is so well established and so confined by expensive plant installation that radical changes must of necessity be slow even though the advantages of such changes are evident. Frequently new plants are built to almost duplicate older establishments because of the economic risk in trying new methods or devices that are not completely accepted.

This type of procedure falls flat in dealing with the newer metals that are attracting so much attention these days. The air is full of talk about the desirable properties of titanium, vanadium, zirconium, chromium, molybdenum, germanium, and other metals even more rare. What metallurgist would dare to design and recommend the construction of a large plant for the production of any of these metals when he knows that the developments of the following year might make his whole plant obsolete?

Titanium

The prize example of this dilemma faces the titanium industry. Production for 1950 is estimated at about 60 tons, which, even at $5 to $10 per pound, is a mere nothing in comparison with copper or aluminum. However, demands of the armed forces and the great interest of industry will warrant an expansion of many times this year's production.

Chief producers of titanium today are the National Lead Co. and du Pont. National Lead Co. production is fabricated by Allegheny Ludlum Steel Corp. and marketed by Titanium Metals Corp. Du Pont production has been fabricated by Remington Arms and these two have recently joined with Crucible Steel to market the metal under the trade-name of Remcru titanium.

As far as is known, both companies use the Kroll process of reducing $TiCl_4$ with magnesium, followed by a vacuum distillation to remove the $MgCl_2$ and any excess magnesium. The resulting sponge can be melted in graphite crucibles in a resistance furnace or an induction furnace; another method uses an arc furnace with the titanium held in a water-cooled copper hearth or crucible. The melting, which requires a temperature of about 1800° C., must be done under helium, argon, or in a vacuum.

The Kroll process was chosen by the U. S. Bureau of Mines as the only commercial method of making ductile titanium, but it is a batch process and requires high priced starting materials. Attempts are being made to improve the Kroll method or to find a new method.

Maddex and Eastwood of Battelle have proposed injecting a stream of molten magnesium into a vessel containing $TiCl_4$ vapors. The resulting reaction produces molten $MgCl_2$ carrying small particles of titanium. Laboratory tests have shown that this procedure will work. They then propose to draw molten $MgCl_2$ plus titanium mixture from the bottom of the reactor into an arc furnace. The heat of the arc would vaporize the $MgCl_2$ and at the same

time melt the titanium into an ingot which could be drawn off continuously from the bottom of the furnace.

Consideration has been given to the relative merits of sodium and magnesium as reducing agents. A mixture of the two would have some advantage in producing a more fusible chloride residue which would also be less hygroscopic. Too large a percentage of sodium would cause difficulties because the larger heat of reaction of sodium would create a heat dissipation problem in the furnace. Furthermore, the boiling point of sodium at 880° C. sets a narrow limit to the furnace temperature operation range as it is undesirable to vaporize the reducing agent. Based on investigations in zirconium reduction, Kroll believes that sodium addition should not exceed 12%.

The iodide decomposition process of van Arkel is being investigated to see if it can be used in a continuous process and on relatively crude titanium bearing materials as a starting material. It is reported that the rods of metal 1½ to 2 in. thick and 6 ft. long have been made in contrast with the customary "hairpins" the thickness of a lead pencil and not more than 2 ft. long.

Jaffe and Piker have attempted to make titanium by the reaction of $TiCl_4$ vapors and hydrogen in an arc. They formed a pool of molten titanium in an enclosed arc furnace by melting titanium scrap and then introduced the two gases into the furnace. The equipment failed after a short time, but their analyses showed more titanium in the furnace after the run than before.

Quebec Iron & Titanium Corp.'s first electric furnace at the Sorel smelter was started in October. It is being operated on an experimental basis to determine the operating characteristics and to determine what design changes, if any, will be needed on subsequent furnaces. The furnace with six electrodes and a rectangular hearth about 18x50 ft. will handle 300 tons per day of the 35% TiO_2, 40% Fe ore from the Lac Tio deposit. This ore fed continuously from charge bins and smelted with coke in the arc furnaces will yield about 100 tons of iron and 130 tons of 70% TiO_2 slag. The slag will be cast on a high speed machine using cast iron molds and then crushed for shipment to pigment producers; the iron will have its sulphur reduced to 0.03 to 0.05% and then will be cast into pigs for shipment to steel mills. Additional furnaces will go into operation in the spring of 1951 to bring the smelter capacity up to 1,500 tons daily. Q. I. T. is interested only in producing the TiO_2 bearing slags, but it is known that Kennecott is sponsoring research on the production of titanium metal, possibly by electrolytic methods, and that New Jersey Zinc's research labs are also interested in the metal.

Vanadium

Dr. A. B. Kinzel in a recent article on ductile vanadium states that the next two decades may be known as the Age of Rare Metals because of the many advances in their production. The Electro Metallurgical Division of Union Carbide and Carbon is prepared to deliver vanadium ingots, bar, sheet and foil. Possible applications of the metal are not known, but it has good resistance to reducing acids and salt water plus a high modulus of elasticity. Dr. Kinzel does not describe the actual method of production, but implies that it is similar to the method reported by McKechnie and Seybolt wherein V_2O_5 is reduced by metallic calcium in a pressure bomb. These workers also added iodine to the reaction mixture to increase the heat evolved, but discarded the use of $CaCl_2$ as recommended by Marden. Additions of Al or Al_2O_3 to flux the CaO produced were found to be detrimental as the vanadium was contaminated by aluminum. McKechnie and Seybolt produced a 99.5% pure metal with a 75% recovery. Kinzel reports a 99.8 to 99.9% purity with a 90% recovery.

Zirconium

Plant installation for the production of zirconium metal at the Albany, Ore., station of the Bureau of Mines has been increased substantially first by a special allotment of $350,000 followed by another of $100,000. The process to be used in the enlarged plant is the reaction of gaseous $ZrCl_4$ with magnesium followed by vacuum distillation to produce a sponge. W. J. Kroll and his fellow workers have investigated the possibility of a combined purifying and vaporizing reservoir to supply $ZrCl_4$ to several reducing units. They have also described a special high temperature graphite resistor furnace for producing ZrC from mixtures of ZrO_2 and carbon. The ZrC is then chlorinated to provide $ZrCl_4$ for the reduction process.

Zirconium ores all contain some hafnium which follows along through the reduction processes and eventually ends up in the metal. Producing hafnium-free zirconium is not easy as the chemical behavior of hafnium is almost the same as that of zirconium and there is little basis for separation. Three methods have been examined on a laboratory scale. A partial separation can be made by the selective action of ion exchange resins on a solution containing zirconium and hafnium ions. A second method was based on the selective adsorption of hafnium on silica gel from a solution of the chlorides of the two metals dissolved in methanol. The third method involved a fractional distillation of $3\ ZrCl_4 \cdot 2\ POCl_3$.

Molybdenum

Molybdenum metal is interesting because of its possible use in applications to withstand high temperatures such as are found in gas turbines. Difficulties are encountered in obtaining molybdenum sufficiently ductile to be formed into intricate shapes, and in finding a coating or alloy that will resist oxidation. Several companies can now deliver sintered molybdenum ingots up to 4 in. square and 4 ft. long weighing over 400 lb. Climax Molybdenum can melt in their special arc furnace billets up to 6 in. in diameter weighing 190 lb.; they expect to produce 9-in. diameter ingots weighing as much as 1,000 lb.

Chromium

Production of ductile chromium has been investigated by the U. S. Bureau of Mines at Albany, Ore. By analogy with titanium, vanadium and other metals it was assumed that the brittleness of chromium produced by ordinary methods is due to its oxygen content. Therefore, the research was directed towards making chromium with as little oxide content as possible and then subjecting it to further deoxidation. Anhydrous chromium trichloride was reduced with magnesium metal. The $MgCl_2$ and excess magnesium were removed by vacuum distillation to leave high-purity chromium metal. This metal was further de-oxidized by heating it in a stream of dry hydrogen obtained from the decomposition of zirconium hydride. The chromium thus obtained was hot malleable; that is, above 500° C. a sheet of it

could be bent and cut. There is considerable interest in certain chromium alloys for high temperature applications. These alloys have had the drawback of being quite brittle; if they were made originally from ductile chromium they, too, might show some ductility.

Silicon

Extremely high purity silicon has been made by Lyon, Olson, and Lewis of du Pont to be used in crystal rectifiers. Metal analyzing 99.97% was obtained by reacting gaseous $SiCl_4$ and zinc vapor at 950° C. in an apparatus constructed of silica. This raises the perennial question of whether or not silicon can ever be made ductile and thus serve as a structural metal. Many other metals were thought to be inherently brittle until it was shown that they were ductile and malleable when produced in a very pure state. It may be that the brittleness of silicon is due to its lattice structure which resembles that of diamond and that no amount of purifying will make it malleable.

Copper

New smelter construction is going on at a fast pace. The smelter at Ajo, started in July, is said to be operating successfully at a greater rate than it was designed for. Work is progressing on the new sulphide smelter at Chuquicamata. Mt. Isa plans to open a new $4.5 million copper plant in 1951 that will produce 15,000 to 18,000 tons of copper annually by reverb smelting of calcine made in multihearth roasters.

The $16-million, 12,000-ton Kennecott refinery at Salt Lake City started in August. Casting operations have been proceeding continuously since the latter part of September and it has been found that as long as clean cathodes are charged it is unnecessary to do any blowing or poling. The electrolyte purification plant is being used only to control the copper content; the solutions have not yet reached a high enough nickel content to attempt nickel sulphate extraction.

Cyprus Mines Corp. has started construction of a new leaching plant to treat their pyritic Mavrouvouni ore and recover copper tied up as sulphates not soluble in water and not recovered by present flotation practice. The plan conceived by the Cyprus staff assisted by The Dorr Co. is to leach the ore in leaching drums and to separate the leached material into a sand and slime portion. The sand will be washed in four counter-current classifiers and the slime in four counter-current thickeners. The combined washed sand and slime will go to the present grinding and flotation plant and the pregnant solution to iron cementation. A modern acid plant is being constructed to supply sulphuric acid for leaching. With a leaching capacity of 2,000 long tons per 24 hr., the new plant is expected to give an over-all increased copper recovery of about 10%.

News from operating plants in the U. S. includes the construction of a new 126-ft. reverb at Hurley to be fired by natural gas. From McGill comes a detailed description of the mechanical tuyere punchers. In addition to releasing the workers from a hazardous and unpleasant job, the mechanical puncher makes it possible to increase the copper production rate by 15 to 20% on the same grade of matte.

Schloen and Elkin have written a review of the methods used at five different plants for the treatment of coppery refinery slimes. This review covers about all known methods now in use and has a valuable bibliography for reference.

The Wilkins-Poland resistor furnace for distilling zinc from brass has been well described in the literature. A 1,000-kva. unit is now being built to melt copper cathodes. An electro-magnetic pump designed by Ajax Engineering will be attached to the furnace and used to deliver an accurate amount of metal to the molds, thus eliminating the necessity of tilting the furnace.

Melting cathodes in an arc furnace has many advantages over the old reverb practice, but still has certain disadvantages such as significant electrode consumption, volatilization of copper, fluctuating power consumption, and the requirement of dense thoroughly washed cathodes. It is thought that the resistor furnace will avoid these troubles. The plan is to preheat the cathodes to about 1,400° F. before charging to the melting furnace so as to reduce the sulphur content and eliminate the necessity of blowing and poling. Then the melting in the resistor furnace can be done efficiently under a controlled atmosphere with little consumption of resistor or brick-work.

Lead

Almost every review of lead metallurgy in the past two decades has mentioned the latest news from Port Pirie either in regard to continuous refining or to the latest change on their large and unusual blast furnaces. The whole story of the development of the Port Pirie blast furnace has now been described by L. A. White in a recent article with diagrams to show the evolution and an explanation of the reasons for the changes.

A. A. Collins reports that a Port Pirie type furnace has been in successful operation at Chihuahua for over a year. This furnace is 20 ft. long, 10 ft. wide at the upper tuyeres, and 5 ft. wide at the lower tuyeres. Some trouble has been experienced with a basket feeding arrangement but is being corrected.

At the El Paso Smelting Works it has been found that the waste slag from the slag fuming furnace carries small amounts of matte. A small reverb which will hold 60 tons of slag and 20 tons of matte is being built to settle this slag and recover a matte running about 10% copper.

Matte From Slag

At the same smelter the blast furnace charge now averages 27% lead, 5% copper, 1.7% arsenic, and less than 2% sulphur. All of the lead is brought forward to the first settler, and the lead, copper speiss, iron speiss, and a small amount of copper matte are all tapped together and transferred to a cast iron drossing kettle. Wet dross is skimmed from this kettle with a clamshell bucket and transferred to the reverberatory dross furnace. The heavy dross fall contains considerable iron speiss and constant cleaning of the kettle sides with a pneumatic chisel is necessary. Approximately 100 tons of dross per day is charged to the reverb along with salt cake and coke breeze to produce an iron free copper-bearing speiss and an iron-bearing soda matte; both products low in lead.

Tittmann and Hase have described the perfection of water sealed wind boxes for D-L machines at the El Paso Smelter. Wind box lead is granulated upon striking the water and most of it can be scraped out through a water seal without breaking the vacuum. A more thorough cleaning must be made once a day, but this requires only 45 min. as contrasted with the usual 4 hr. The longer operating time made available increases the capacity of the machine 100 tons per day. On a charge running 20% lead, four boxes yield 16 tons per day of which 6 tons goes to the furnace and 10 tons to the raw sinter charge.

The D-L plant at Herculaneum is being modernized, according to W. T. Isbell. When completed it will have two 6x33-ft. machines for first pass sinter, followed by a cooling, crushing, and sizing plant for preparation of feed to two more 6x33-ft. machines to give a finished sinter.

Preparation of D-L sinter charge is being given a great deal of attention. At Trail the zinc plant residues in the form of a slurry, along with the other D-L charge ingredients, are introduced into a drum or kiln to be mixed, dried, and nodulized before sintering. At Bunker Hill a pilot plant is being constructed to mix, dry, and nodulize the D-L charge in three separate pieces of equipment rather than in one. Immediately following satisfactory results from the pilot plant, an entirely new D-L charge preparation plant will be built.

Bunker Hill is now installing two 5x15-ft. continuous softening furnaces similar to the ones developed at Port Pirie. It has been said that continuous softening can only be used where the bullion composition is quite uniform, but careful preliminary tests at Bunker Hill have shown that the method is applicable even though the arsenic and antimony content varies widely.

Other improvements planned at Bunker Hill include a vacuum dezincing unit, new facilities for collecting D-L fume, and a new crushing plant.

Three papers by G. L. Oldright issued by the Bureau of Mines describes in detail his investigation of lead smelting in the ore hearth as well as the history of its development to determine if the ore hearth might not have wider application with better concentrates that can be made by present day concentrating methods.

Hearth Smelting at Trepca

John S. Stewart described the ore hearth installation at Trepca. The 8-ft. hearths were fed entirely with flotation concentrates running 80% Pb. The average production was 20.77 tons of bullion per hearth per day, although production as high as 26.18 tons was reached. Mr. Stewart believes that further mechanization would widen the field of application of the ore hearth.

At Rhodesia Broken Hill the Newnam hearths are being replaced by a new sintering and blast furnace plant to permit treatment of a large tonnage of zinc plant residues containing 16% Pb.

Very little has been published about the Kroll-Betterton process for debismuthizing lead by calcium and magnesium additions since the article by Betterton and Lebedeff 14 years ago. A recent German article by Grothe describes a similar procedure except that the operating temperatures are slightly lower and there is no mention of the recirculation of the reagent dross. A second German article by Evers gives some details on the additional removal of Bi by additions of Sb, a point which was mentioned but not amplified by Betterton and Lebedeff. Evers' method is to reheat the lead to 370-380° C. after the Ca-Mg-Bi dross is removed and to add 0.15 to 0.25% Sb in the form of hard lead. The kettle is then cooled to 340° C. and skimmed; the residual metal is 80 to 86% of the charge and contains only 0.006 to 0.007% Bi.

Zinc

New Jersey Zinc Co. at the end of September put into operation nine new vertical retorts at its Palmerton plant, bringing the total to 43. These retorts replace the last of the old horizontal blocks with which Palmerton was originally equipped.

The new retorts are larger and are equipped with splash condensers. As a result, there is about 25% increased capacity per retort with smoother operation and better condensation efficiency.

Two major improvements have been made in firing. In the old batteries waste gases from the recuperators were passed through the cokers where briquettes were coked before charging to the retorts. This limited heat recovery in the recuperators. The new battery has an autogenous coker permitting completely independent operation of the retorts and cokers. A recuperator of new design is used with a resultant fuel economy of over 15%. Other refinements in design result in reduced labor and better operation.

A. S. & R. plant at Amarillo is using a charging machine on all but two blocks of horizontal retorts. One of the two blocks is being hand charged on a 48-hr. firing cycle and one on a 24-hr. firing circle. This is being done to compare mechanical charging with hand charging and the two lengths of cycle. Sufficient data have already been obtained to show the advantages of mechanical charging.

At Blackwell, Okla., the American Metal Co. is in the process of installing the enormous 12x168-ft. sintering machine described in last year's review.

A 25% extension to the electrolytic zinc plant at Rhodesia Broken Hill will use selective leaching of certain flotation tailings containing zinc silicate. The leach is conducted at a constant pH of 1.9 to 2.0 to achieve a high extraction of zinc and yet leave the vanadium minerals relatively unattacked. Ordinary methods of leaching would dissolve most of the vanadium minerals and necessitate additional iron to purify the solution. The selective leach also leaves the fluorin minerals unattacked. Florine in the solutions is to be avoided because it etches the aluminum cathodes which are then difficult to strip.

The problem of depositing electrolytic zinc on zinc starting sheets has been investigated by the Bureau of Mines. In one series of tests, solutions were especially purified by treatment with potassium permanganate and cathodes as thick as 2.6 in. were made of the zinc sheets. Other tests showed about the same efficiency for rolled zinc starting sheets as compared with aluminum cathodes. Zirconium and titanium cathodes were also investigated; a zirconium cathode was easily stripped after 15 days of deposition.

Resistor type furnaces for the recovery of zinc from copper base alloys and galvanizers' dross has been described by Wilkens and Poland. Two of these furnaces are now being constructed abroad, one a 750-kva. unit by the National Smelting Co. at their Bloxwich Works in England and another 450-kva. unit by the Societa Metallurgica Italiana near Florence, Italy. Both installations are intended to recover metallic zinc from copper base scrap alloys, the residual metal after a short refining operation to be used in the production of ingot metal. The iron in the residual metal along with silicon and aluminum will be removed by a short blow in a small converter.

Nickel and Cobalt

Growing demand for nickel has caused an acute shortage of the metal and stimulated activities to increase the supply. The U. S. Government-owned Nicaro Nickel plant in Cuba will be reactivated by Mining Equipment Corp., New York, a subsidiary of N. V. Billiton, and in production by the end of 1951. Freeport Sulphur Co. operated the

(*Continued on page* 183)

OPERATING IDEAS

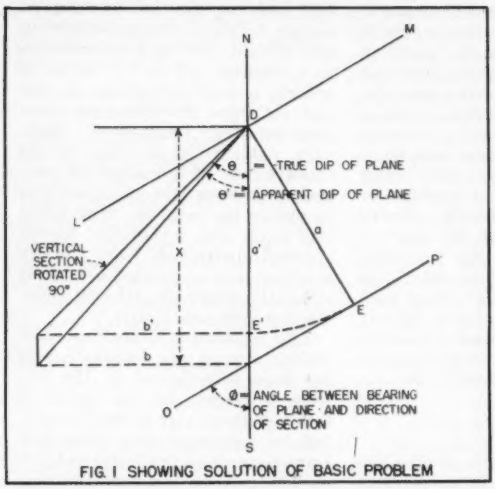
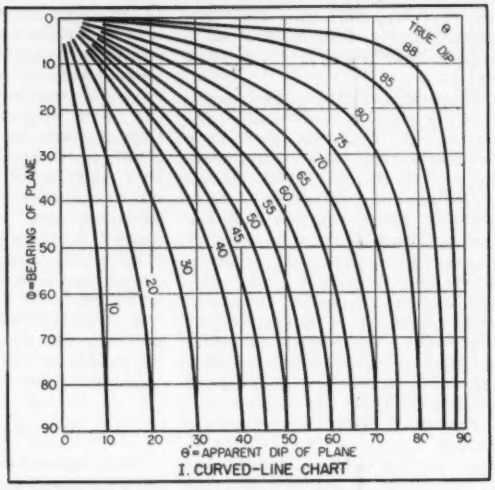


FIG. 1 SHOWING SOLUTION OF BASIC PROBLEM



Three Charts to Aid in Solving Geological Problems

CAMPBELL FOX*

CHARTS MAY BE USED EFFECTIVELY to solve geological problems which might otherwise require graphical or mathematical solutions. The following article describes one type of geological problem which occurs frequently and may be solved readily with charts. An example of each of three different types of charts is given and an explanation of how they are made.

The Problem. To determine the apparent dip of an inclined plane where it intersects the section, given the true dip of the inclined plane and the horizontal angle it makes with the section. In practice these problems may be solved by charts:

1. To plot inclined faults diagonal to a section.
2. To plot inclined geological contacts diagonal to the section.
3. To plot inclined veins diagonal to the section.
4. To plot a raise section when the raise is diagonal to the section.

The following charts assume that the plane of the section is vertical and north-south, but any individual case may be adjusted by changing the wording of the chart. For example, the words "bearing of plane" may be changed to read "acute horizontal angle between the inclined plane and the vertical cross-section."

Fundamental formula for this problem:

$\text{Tan } \Theta' = \text{Tan } \Theta \text{ Sin } \phi$, where Θ' = apparent dip of plane; Θ = true dip of plane; and ϕ = bearing.

Referring to Fig. 1, line N-S represents the horizontal projection of the plane of a vertical cross-section. LMOP represents an inclined plane intersecting the vertical section at point D on the lower elevation, and point E at a higher elevation. The difference in elevation is represented as b. a = the shortest possible distance between the horizontal trace of the plane through point D and the horizontal trace of the plane through point E. ϕ = the acute horizontal angle between the bearing of the plane and the direction of the section.

In Fig. 1. $a = a'$, $b = b'$

$$\text{Tan } \Theta = \frac{b'}{a'} = \frac{b}{a}$$

$$\text{Tan } \Theta' = \frac{b}{x}$$

$$\text{Sin } \phi = \frac{a}{x}$$

$$\text{Therefore Tan } \Theta' = \frac{\text{Tan } \Theta \, a}{\frac{a}{\text{Sin } \phi}} = \text{Tan } \Theta \text{ Sin } \phi$$

Graphical Solution: Referring to Fig. 1, values for Θ and ϕ are given. Θ' is to be determined.

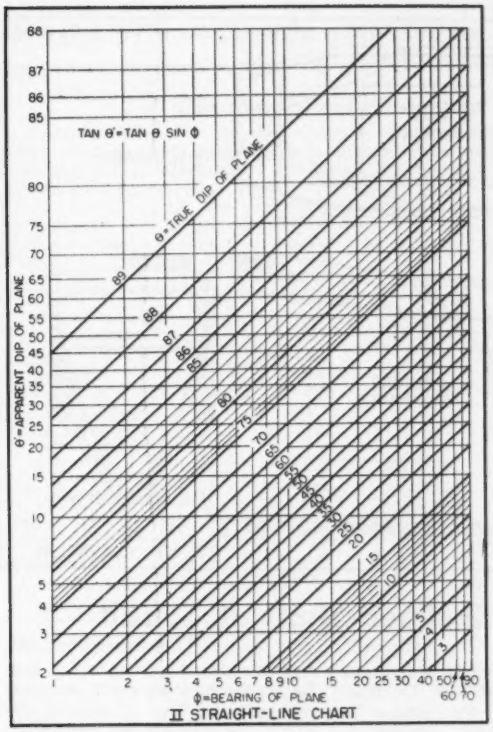
Draw line N-S and the vertical cross-section. Draw lines LM and OP at angle ϕ to the section. Draw perpendicular LM. Represent this as line "a." Scale the distance "a" and make "a'" drawn from point D, equal to "a." Draw angle Θ with vertex at D and one side a'. Erect b' to intersect hypotenuse of triangle. Erect perpendicular b = b' at point E. Draw the hypotenuse of this triangle and measure the angle indicated as Θ' with a protractor.

This problem may also be solved with three charts:

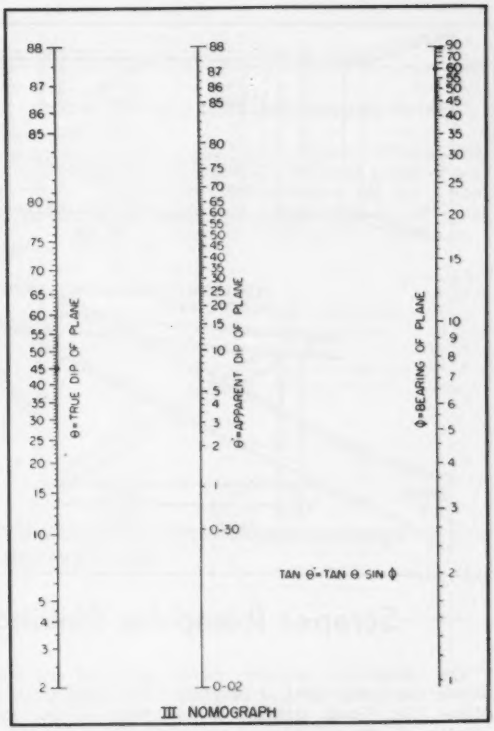
1. Curved Line Chart.[1] This chart was constructed by solving the formula of the form $f(u_1) = f(u_2)$, $f(u_3)$ by substituting a constant "K" for $f(u_2)$ (for each curve, or in this case let Tan Θ have a different value for each curve). On perpendicular axes construct graphical scales. X = the values of Tan Θ' from 0° to 90°, and Y = values of Sin ϕ from 0° to 90°. These values are spaced at even intervals as shown. Enough values are calculated for each curve

*Consolidated Beattie Mines, Ltd., Duparquet, Quebec.

[1]The author makes it clear that this chart is not original, it is included to demonstrate its value in comparison to other solutions to the problem.



II STRAIGHT-LINE CHART



III NOMOGRAPH

to give a smooth curve, and enough curves are plotted to give the results desired.

II. Parallel Straight-Line Chart. To bring the formula Tan $\Theta' =$ Tan Θ Sin ϕ under the straight-line type, it is transformed to the logarithmic type, log Tan $\Theta' =$ log Tan $\Theta +$ log Sin ϕ. Let log Tan Θ have a different value for each straight line, but for a single line it will have a constant value, of course.

On perpendicular axes plot functional scales $f(\phi) =$ log Sin ϕ, when ϕ varies from 1° to 90°, and $f(\Theta') =$ log Tan Θ' when Θ' varies from 2° to 88°.

To construct functional scales for this chart—for log Sin ϕ when ϕ varies between 1° and 90°. Notation:

L = length of scale.
m = scale factor.
$f(\phi_1) - f(\phi_2)$ = the difference between the maximum value of log Sin ϕ and the minimum value of log Sin ϕ.

Using the formula $m = \dfrac{L}{f(\phi_1) - f(\phi_2)}$

taking L = 211 units (20 units = 1 in.

$m = \dfrac{211.0}{1.758} = 120.$ (If this number does not come out even, round it off and change L to fit.)

Derive the following table:

ϕ	1	2	3	4, etc.
$f(\phi)$=log Sin ϕ.....	8.242	8.543	8.719	8.844
L=120 (log Sin ϕ—log Sin 1°)	0	36.1	57.2	72.2

From this table the values of the variable are plotted on the horizontal functional scale according to the distance "L." Derive a similar table for the functional scale of log Tan Θ' after choosing the length of line desired. After plotting the functional scales log Sin ϕ and log Tan Θ' at right angles to each other, plot a straight line for each degree of tan Θ (from $\Theta = 2°$ to $\Theta = 89°$). To make the reading clearer, emphasize the lines for all values that are multiples of 5°.

III. The Nomograph. This is also constructed by means of logarithmic transformation of equation Tan $\Theta' =$ Tan Θ Sin ϕ to log Tan $\Theta' =$ log Tan $\Theta +$ log Sin ϕ.

Procedure: 1. Draw two parallel straight lines as shown in Chart III along the edges of the sheet.

2. Along the left side plot the functional scale for log Tan Θ as in Chart II.

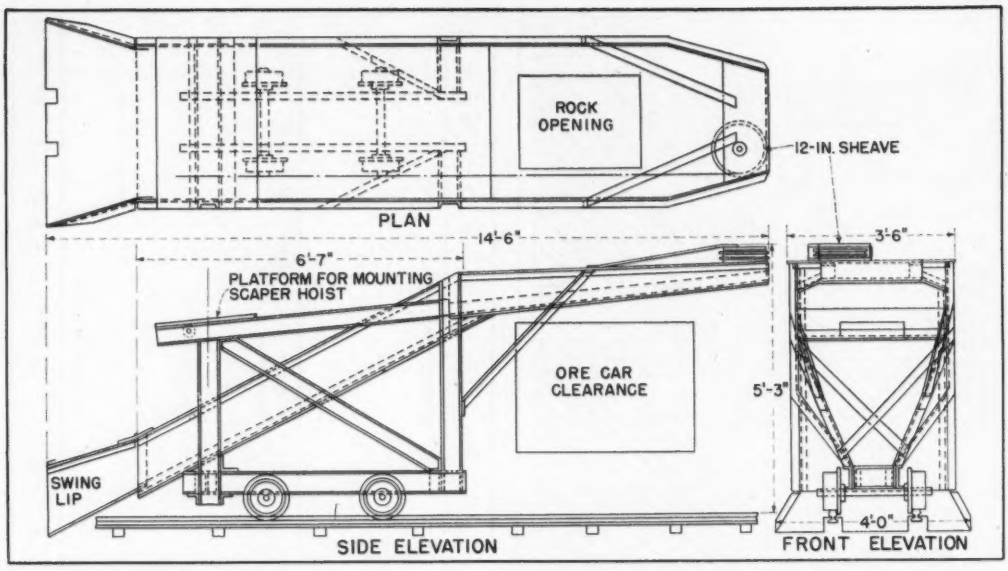
3. Along the right side on a parallel line of equal length plot the calculated functional scale for log Sin ϕ in the same manner as previously explained, but making variations for the new value of "L." In both scales, plot the functional scales increasing from the bottom of the page.

4. Now locate a point on the intersection of two lines drawn from different positions on the parallel functional scales.

e.g., (a) let $\Theta = 80°$ and $\phi = 2°\ 55'$
(b) let $\Theta = 30°$ and $\phi = 30°$

Therefore, $\Theta' = 16°\ 6'$, the point of intersection. A vertical line drawn through this point locates the functional scale for log Tan Θ'. Values are now obtained for the maximum and minimum points of this scale and the functional scale is calculated and plotted as in previous cases.

Advantage: The nomograph is easier to construct and to use, and thus the most practical chart.

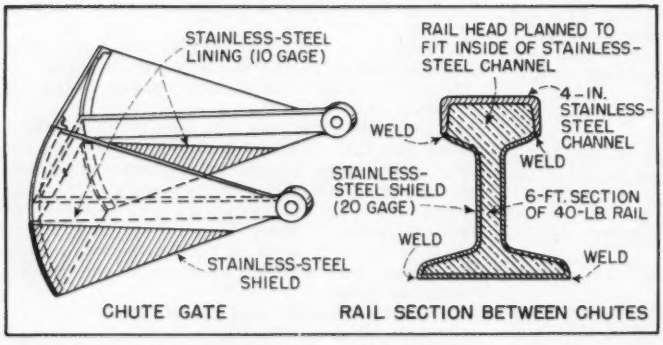


Scraper Ramp for Sinking Inclined Shaft at Cobalt

The shop-built scraper ramp shown above was used at Mayfair Mines, Ltd., Cobalt, Ontario, in the sinking of a 30-deg. inclined winze, driven to contact several silver and cobalt veins somewhat deeper and a short distance away from the main shaft on the property. The unit was constructed from an old 5-ton mine car and a used scraper hoist. The hoist is mounted on the platform shown, and the scraper is pulled over the rock opening by means of a 12-in. sheave. Cost of the entire scraper-ramp assembly was $135.

By sinking the winze directly toward the new veins, the management avoided the extra cost of first deepening the main shaft, and then crosscutting. Cost of sinking the winze was only $38 per vertical ft. as compared with $100 per ft. for the main shaft. E&MJ is indebted to Leo Gough of the mine staff for submitting this drawing and information.

Stainless Steel Prolongs Equipment Life



Acid mine water caused rapid deterioration of equipment used at ore-loading points at the Hornet mine of Mountain Copper Co., Ltd., Iron Mountain, Shasta County, Calif., where pyrites are mined and crushed for shipment to chemical plants. Chute gates, chute bottoms, gate guides, and 6-ft. rail sections beneath loading chutes were especially affected. The life of chute bottoms did not exceed 6 weeks, that of chute gates and auxiliary parts was less than 2 months, and rail sections also failed rapidly. To assure continuous loading operations, spare units had to be manufactured and stored for quick change.

Then stainless steel was substituted for affected parts with the result that chute bottoms installed some 18 months ago show little or no wear, chute gates lined and shielded with 10-gage metal now last more than 12 months, and shielded rail sections last for many months.

As the cost of parts made entirely from stainless steel was prohibitive, the parts of the chute equipment exposed to acid mine water were lined and shielded as shown. The 6-ft. rail sections installed below each loading chute were shielded with 4-in. stainless-steel channels and with 20-gage stainless-steel plate. The head of each rail section is planed to fit inside the channel, and the sides and bottom are covered with plate as shown.

MARKETS—Trends and Prices (*Continued from page* 69)

Canada's Metal Production

Estimated value of all metals produced in Canada in 1950 was $620,910,060, which compares with $538,967,258 in the preceding year, according to the Dominion Bureau of Statistics. Production of metals in 1949, and preliminary figures for 1950, follow:

		1949		1950	
		Quantity	Value	Quantity	Value
Antimony	lb.	158,288	$ 61,020	650,000	$ 217,750
Bismuth	lb.	102,913	210,972	223,004	501,759
Cadmium	lb.	846,541	1,735,409	834,218	1,925,386
Calcium	lb.	520,609	1,041,218	281,800	338,160
Chromite	ton	361	7,148	.....	.....
Cobalt	lb.	619,065	952,469	626,400	1,039,910
Copper	lb.	526,913,632	104,719,151	523,828,637	122,552,157
Gold	fine oz.	4,123,518	148,446,648	4,430,612	168,540,479
Indium	fine oz.	689	1,550	4,950	12,078
Iron ore	ton	3,675,096	21,203,907	3,617,174	21,083,613
Lead	lb.	313,549,865	50,488,879	339,776,962	49,097,771
Magnesium	lb.	.....	.....	3,540,000	831,900
Molybdenite (MoS_2)	lb.	.....	.....	103,508	60,035
Nickel	lb.	257,379,216	99,173,289	246,113,800	113,564,805
Palladium, rhodium, iridium, etc.	fine oz.	182,233	8,289,915	148,342	13,596,644
Platinum	fine oz.	153,784	11,603,002	121,100	9,970,163
Selenium	lb.	318,225	652,361	356,200	862,004
Silver	fine oz.	17,641,493	13,098,808	22,416,150	18,116,732
Tellurium	lb.	11,692	21,046	48,900	92,910
Tin	lb.	619,117	633,047	796,000	827,840
Titanium ore	ton	540	2,892	100,500	261,500
Tungsten (WO_3)	lb.	252,380	252,380	3,000	2,900
Zinc	lb.	576,524,097	76,372,147	622,450,891	97,413,564
Total Metallics	...	.....	$538,967,258	.....	$620,910,060

Official London Prices

The British Ministry of Supply continues to fix delivered prices of copper, lead and zinc for the United Kingdom. Quotations in effect as January ended were as follows:

	Per Long Ton £	s.	d.
COPPER			
Electrolytic, high conductivity	202	0	0
Fire refined, high conductivity	202	0	0
Fire refined, high grade	201	10	0
Fire refined, min. 99.7 percent	201	0	0
Fire refined, min. 99.2 percent	200	10	0
LEAD:			
Soft, foreign duty paid	136	0	0
Soft, Empire	136	0	0
English, refined	137	10	0
ZINC:			
Foreign (G.o.b.) duty paid	151	0	0
Domestic (G.o.b.) duty paid	151	0	0
Prime Western and debased	151	0	0
Refined and electrolytic	155	0	0
Minimum 99.99 percent	157	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

January 31, 1951

Aluminum, ingot, 99 plus percent, lb. (base price)	19c.
Antimony, spot, lb., 5 tons and up but less than carload in cases	45.280
Bismuth, ton lots, lb.	$2.25
Cadmium, commercial sticks, delivered, lb.	$2.55
Calcium, 1 lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.07
Cobalt, 97 to 99 percent, per lb.	(b)$2.10
Indium, troy oz.	$2.25
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	50¼c.
Magnesium, 99.8 percent, carloads, lb., producer's plant, Freeport, Texas	24½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$90.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$220
Selenium, 99.5 percent, lb.	$2.00
Silicon, minimum 97 percent, spot, carloads, lb.	16.50c.
Tellurium, lb.	$1.50@$2.00
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 96 to 98 percent, lb.	$5.00

(a) Includes U. S. duty. (b) Effective Jan. 1, 1951.

METALLIC ORES

Beryllium Ore, imported, 10 to 12% BeO, per unit	$28.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 44% Cr_2O_3, no ratio	$24.00@$25.00
48% Cr_2O_3, 3 to 1 ratio	$38.00@$48.00
Iron Ore, Lake Superior, Lower Lake ports, long ton: Old Range bessemer	$8.70
Mesabi bessemer	$8.45
Mesabi, non-bessemer	$8.30
Lead (Galena), 80 percent, Joplin, Mo., ton	$218.42
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, 92 @ 86c., c.i.f. U. S. ports, duty extra. Long-term contract quotations wholly nominal and matter for negotiation.	
Molybdenum Ores, 90%, per lb. of MoS_2 f.o.b. mines	60c.
Tantalite, 60% concentrate, per lb.	$2.00@$2.75
Tungsten Ore, per unit of WO_3 Foreign, 60 percent, duty paid	$73.00
Domestic, scheelite, 60 percent f.o.b. mine	nominal
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo. per ton	$115.00

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	6½c.
Cobalt Oxide, 72%, metallurgical grade, per lb. of Co	(b)$2.25
Copper Sulphate, 100 lb.	$8.95

(b) Effective Jan. 1, 1951.

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of alloy, 5 lb. ingot	$1.56
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	21¾c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$185.00
Ferromolybdenum, 55 to 65 percent Mo, lb. of Mo. contained	$1.32
Ferrosilicon, 50 percent, per lb. of contained Si	12.4c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$3.25
Ferrovanadium, per lb. of V delivered	$3.00@$3.25
Silicomanganese, 1½ percent 7, per lb. contracts	9.9c.
Spiegeleisen, per long ton, 19@21%	$75.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds), ton: Crude No. 1	$960@$1,500
Crude No. 2	$595@$900
Spinning fibers	$275@$475
Shingle fibers	$123@$170
Paper stock	$85@$119
Waste	$63@$70
Shorts	$39@$62
Asbestos, Vermont, f.o.b. Hyde Park: Shingle stock	$97.00@$107.00
Paper stock	$68.50@$85.00
Waste	$51.00
Refuse or shorts	$25.50@$46.50
Barytes, f.o.b. mines: Georgia, crude, per long ton	$13.00@$13.50
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.25@$9.50
Bauxite, long ton, f.o.b. point of shipment: Domestic, crude, 50 to 52 percent (not dried)	(a)$4.50@$5.50
Domestic, chemical, 55 to 58 percent	(a)$8.50@$9.50
Domestic, abrasive, 80 to 84 percent	$18.00@$18.50
China Clay, f.o.b. mines, ton: Georgia, filler and ceramic grades	$8.50@$9.50
North Carolina, ceramic grade	$20.25@$22.25
Feldspar, bulk ton: Potash or soda fedspar, 200 mesh, ceramic grade	$18.50@$22.25
Glass par, white, 20 mesh	$11.75@$12.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois, 70% effective, CaF_2, ton	$43.00
Acid 97% concentrate, bulk, ton	$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$36.20
Mica—Domestic, f.o.b. mines. Punch, 12 to 22c. per lb. according to size and quality. Sheet, clear, 1½ x 2 inch, 70 to 75c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.40@$1.50; 3 x 3 inch, $1.70@$1.80; 3 x 4 inch, $2.10; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $120@$130 per ton. Bulk sales, dry ground, $32.50@$60.00 per ton. Scrap, $30 and up.	
Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, c.i.f Atlantic ports	(a)12@14c.
Sulphur, Texas, mines, long ton	$22.00
Talc, f.o.b. works, ton: New York, purified	$18.50@$20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton: 40 mesh, cream colored	$30.00

(a) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces	$52.00
Steel, f.o.b., Pittsburgh billets, net ton	$56.00
Structural shapes, 100 lb.	$3.65

WASHINGTON REFLECTIONS

Washington Is Again a Maelstrom as Alphabet Agencies Wrestle with Controls

Those who remember Washington in 1942 and 1943 would find its present condition as repetitious as the playing of an old record. All the carefully prepared, expensively concocted plans are cast aside. Frustration and confusion reign. Again the hotels are booked to full capacity as a horde of business men rush to assure themselves places on the gravy train. Again regiments of newcomers are undertaking the colossal job of administration, crowding into inadequate office space, their desks piled high with indigestible stacks of papers, exchanging scuttlebutt, competing for authority, and devising the inevitable forms and organization charts. Much of their time is taken up by friends from home or industry, or by the resourceful citizens who, not contented with seeking help at the proper places, struggle to invoke the influence of higher authority, to exert pressure from Congress, to reinforce their chances by duplicating their applications elsewhere, and to persuade the wife's uncle's old friend to get a letter on White House stationery. Again the observer is struck by the spirit of profit-seeking rather than sacrifice and by the impression that the worst turn an enemy could do himself would be to wipe this capital of confusion off the face of the earth.

Much of the confusion is due to the initial error of parceling out the defense job to the various sprawling, protocol-ridden departments and their politically-minded high commands. This error is quite evidently on the way to correction. Few observers doubt that the newly organized Defense Production Administration, which now sits above the departmental functions, will take the jobs away from the departments as rapidly as they prove their incompetence. The Defense Production Administration, or its alphabetical successor, will undoubtedly assume a status similar to that of the old War Production Board. This does not mean, however, that those elements in the departments which prove to be useful will not be utilized.

As this is written, the industrial mobilizers are blaming the Defense Establishment for failure to produce a plan, and the latter insists just as stoutly that reasonably accurate estimates of requirements have been provided.

This plan will call for a build-up of armaments as rapidly as possible to a limited strength considered to be safe, with the production job spread through as many plants as possible. Such a system will render production less vulnerable to bombing, will facilitate quick conversion to wartime production, and will minimize the obsolescence problem. After this limited level of armament production has been held long enough to produce a safe inventory, it will be reduced.

Full Control Foreseen

The problem of balance in this scheme of operations is very difficult. A safer armament position must be attained before the Soviets have a tempting atomic-bomb striking power, but the long-term effort must not be allowed to break the country's back economically. At the present time the Defense group believes that "eager-beaver" economic mobilizers are pushing the country too rapidly into complete controls, some of which may prove to be unnecessary and provocative of public discontent. The industrial group has already undertaken to set general price and wage ceilings, and clearly intends to drive toward full allocation of key materials as rapidly as possible. They intend to make the "single band" priority system— the "DO" orders, already widely abused by illegal extension—work as long as possible. At the present time these orders can only be initiated by the Defense Establishment, the Atomic Energy Commission, and certain foreign countries, and extended by their suppliers for materials and components which appear in their products. They cannot be used for capital equipment or for maintenance and repair items. Therefore, the only way in which they now affect the mining industry is in the disposition of its products. Other needs are being handled by specific directives on a spot basis.

The accommodation of price controls to international markets will undoubtedly be by Government purchase of imports and by an international raw-materials allocation system.

Mineral Applications Jammed

In the mineral field, the Defense Production Administration is swamped with several hundred applications for financial assistance, and only a few have been cleared. Under the Defense Production Act, the agency has the power to certify the guaranteeing of private-bank loans by the Federal Reserve Bank, the making of loans by Reconstruction Finance Corporation, or the consummation of purchase contracts by Emergency Procurement Service.

The administrators deem the Act to include the power to subsidize exploration, development and production and are being pressed by interested members of Congress to undertake to carry out the aims of the O'Mahoney bill (S-2105), which failed to pass the 81st Congress. Their problem is complicated, however, by the circumstance that the tax positions of beneficiaries are very uncertain if repayment in case of success is required, and by the lack of a clear picture of what defense requirements will be. Also, at the present time no funds have been allocated for subsidizing production that would flow to the general market. Stockpile funds can be used for attaining stockpiling objectives. However, any over-the-market purchases require a finding of fact that supplies cannot "be effectively increased at lower prices or on terms more favorable to the Government."

The Requirement Division of DMA is handling a number of requests daily from mines and mining machinery manufacturers to help obtain needed materials, equipment and supplies. This office is clearing these requests rapidly but the problem of supply is becoming complicated by the degeneration of the present priority scheme. Assistance is normally forthcoming in the shape of special directives by the National Production Authority to specific suppliers to satisfy the needs. No special forms are used, but the applicant should describe the needed items and the purpose for which needed, state where they can be normally obtained, identify his supplier, and tell why the supplier is unable to deliver.

Mining industry applicants for accelerated amortization should obtain Form NSRB-140 from Government field offices or Washington headquarters of the Commerce or Interior departments. Applicants for financial assistance should obtain Form NSRB-146. Form 140 has 9 pages and Form 146 has 12 pages. Both of them contain questions that will confound the unlettered, confuse the small operator, and irritate everybody. However, this seems to be the inevitable Government routine, and until these forms are improved, we counsel applicants to fill them out as completely and carefully as possible; otherwise, they will only suffer delay and further irritation.

When an application for financial assistance comes to DMA, it is first studied by the Supply Division, and the essential features of a contract are negotiated. Field examinations where necessary are carried out by

field men of the Geological Survey, Bureau of Mines, and RFC. When a basic understanding is reached with an applicant, he is handed over to the Production Expansion Division, where, in collaboration with representatives of other Government agencies, contractual details are ironed out. DMA, however, does not sign any final contracts, but simply certifies projects to EPS, RFC or the Federal Reserve Bank. The applicant then carries on with them.

Foreign Scope Uncertain

The extension of the Defense Production Act into the foreign mineral area remains doubtful. Foreign producers in ECA countries should lodge their claims for otherwise unobtainable equipment and supplies with ECA through their respective governments. Those in other countries should lodge claims with the Commerce Department's Office of International Trade. However, although DMA is negotiating with foreign producers, the geographic limitation clause of the Act makes it unlikely that loans can be made for exploration, development or production except under pre-existing authority of such agencies as ECA and Export-Import Bank. Purchase contracts can, of course, be made by General Services Administration and the Export-Import Bank can lend money for projects. ECA can make both loans and risk-money commitments, but only to Marshall Plan areas.

In ECA, the new emphasis on defense has caused renewed activity in the Strategic Materials Division, which is expanding its operations. The agency is no longer restrained by lack of local currency in certain areas, and several projects are being studied. An important manganese project has been cleared and a large copper project is in view.

Brief, But Important

TARIFF—Views are conflicting. One source says that the State Department will leave the copper tariff alone because of its interest in renewal of the Reciprocal Trade Act. Preponderant view is that copper, lead and zinc tariffs will all be temporarily waived as an emergency measure.

DEFERMENT: Mining and smelting companies should send lists of key personnel in military reserves and National Guard to Defense Minerals Administration, Dept. of Interior, Wash. 25, D. C., in order to obtain proper consideration under new deferment policy. Lists should be separate for each military service, and should give names, ranks, serial numbers, locations, occupation, length of deferment sought, and justification.

LABOR THIS MONTH

Joseph M. Gambatese, McGraw-Hill Washington News Bureau

COPPER SURVEY: Government survey of the manpower situation Dec. 1 in 17 copper mines with 82% of the industry's employment shows:

All but one mine had a "comfortable" labor supply. The exception, a large company, is adversely located, has high turnover rate of 8.8%. (Average turnover for all mines: 4%.)

Employment had increased little since Korea, and little expansion was planned. (Copper employment has been pretty static over the past three years, ranging between 27,000 and 28,000.)

Workweek already had reached wartime length of more than 45 hours. Average in October: 45.8 hours, same as peak production period in 1943. Only one mine was working less than 40 hours. Twelve were working at least 48 hours, and three more than 50 hours.

CRITICAL LIST: Underground metal miners have been added to the list of critical occupations by the Labor Department. This includes drilling, handling explosives, timbering, track-laying, and shaft sinking.

WHAT TO DO: Defense Minerals Administration is going at the problem. Ideas getting attention:

Defer copper miners from the draft.

Stabilize employment. (Raising wages may help.)

Import Mexicans. (Get union approval.)

MANPOWER CHIEF: Heading up DMA's Manpower Branch is Stephen W. Wood. During war he handled inter-regional transfers of workers for the War Manpower Commission.

MANPOWER CURBS: Tough manpower controls aren't expected this year. Plan is to alleviate manpower shortages by voluntary devices through 13 regional Labor-Management-Government committees and area committees in places or tight labor supply. Truman's tough policy will be used when and if necessary, but nobody looks for it to bite before next year.

Truman would let Government agencies: (1) control job separations (to reduce labor turnover); (2) impose manpower ceilings as to number of employees and types of skills (to improve utilization of labor); (3) control hiring (to curb labor pirating); (4) enforce greater use of women, handicapped workers and Negroes.

DRAFT: Some form of universal military service seems likely to supplement the draft by June. If 18-year-olds are taken, veterans and married men won't be necessary to build up armed force of 3,462,000.

WAGES: Are up about 10c. an hour in metal mining since Korea. Hourly earnings up from $1.55 to $1.65; weekly from $69 to $75. A Bureau of National Affairs survey of 141 wage settlements during 1950 shows this distribution:

No increase	12
1-3 cents	2
4-6 cents	33
7-9 cents	19
10-12 cents	22
13-15 cents	6
Over 15 cents	3
Pensions	7
Insurance benefits	35
Cost-of-living clause	2

CONTROLS: Wage controls will permit additional increases, about 10% above pre-Korea level. Also "fringe" benefits like improved vacations, health insurance, pensions, etc.

METALS COMMISSION?: Mine, Mill & Smelter Workers wants another special board, like the Nonferrous Metals Commission of World War II, to handle wage stabilization in the industry, and is bringing pressure for it. None is likely right away. CIO's Steelworkers might block it.

BACK TO DENVER: Mine-Mill was moving its international headquarters back to Denver last month. It will find it convenient to have a special wage board in Denver again, as it did during the war. The rival steel union, with offices in Pittsburgh, won't.

NO-STRIKE PLEDGE?: None is in sight, yet. Mainly because Government officials don't think it's needed at this time. John L. Lewis and the left-wing unions, including Mine-Mill, wouldn't give a no-strike pledge, even if we got into a big war. Industry isn't pushing for one, either. Its view: a no-strike pledge wouldn't mean much, and labor leaders would want a concession in return. Suspension of Taft-Hartley, for instance.

TAFT-HARTLEY: No chance of repeal; little chance of revision, in this Congress. Any changes will be limited to those Taft wants, if the labor unions will go along willingly. Taft won't make a fight for his improvements. The alternative: no change at all.

LEGISLATION: There won't be any important labor legislation this year. FEPC bills won't be pushed.

THIS MONTH

FLOTATION MILL of the Emperius Mining Co., Creede, Colo., handles 125 tons a day of gold-silver-copper-lead-zinc ore. Caterpillar diesel-electric set furnishes power for the crushing equipment.

IN THE UNITED STATES

- Pend Oreille Starts New Mill—p. 134
- Feldspar Flotation Increases—p. 153
- Oliver Ships Ore All Winter—p. 155

ALASKA

★According to Leo Saarela, Territorial Commissioner of Mines, an area of about 4 sq. mi. of the **Snettisham iron ore deposit** containing significant amounts of titanium, has been outlined in a report. Work done by Howard M. Fowler, department engineer, warrants further investigation.

★**Gold production** was reported to be 41% higher in the Territory in September than in August. Production was 57,300 fine oz. and 8,241 oz. of silver.

ARIZONA

★The step up of mining to meet **defense requirements** has been reflected in a number of small mines seeking Government loans for expansion. E. C. Corbell, district manager of the Department of Commerce at Phoenix, said that more than 70 operators have applied.

★**Union Gypsum Co.**, of Phoenix, has sold its plant facilities and rights to some 500 acres of high-grade deposits to Certain-teed Products Co., according to an announcement by Carlton M. Rogers, Union's president. Mr. Rogers pioneered the deposits, which he began working in 1946, after securing Federal patents.

The purchase gives Certain-teed seven gypsum plants scattered from New York to Arizona.

★Preliminary work on an open-pit copper operation to remove ore 350 ft. below the surface has been started at Bisbee by **Phelps Dodge Corp.** It is estimated that $25,000,000 will be required to develop the pit, which will be the deepest in the world, according to H. M. Lavender, vice president and general manager for the company's western division.

Officials state that the new pit will be seven times the size of the nearby Sacramento operation, but will not exceed that of the Morenci operation, rated as the second largest in the country. The project, which will be financed with Phelps Dodge capital, will involve preliminary stripping, acquisition of drilling equipment, electric shovels and haulage equipment, installation and equipping of a concentrator and other related facilities.

★Caught in the defense speedup, **Arizona's copper mines** produced an estimated 792,620,000 lb. in 1950, 74,000,000 lb. more than in the previous year and ranking second in all-time state production to 1946, when the 800,000,000-lb. mark was topped. Charles Dunning, director of the State Department of Minerals and Resources, estimated the metal's value at about $167,081,410 on 11-month reported production and one-month estimated production. He indicated that 1951 production probably will set a new record. Phelps Dodge has increased its activities at Bisbee and Morenci; Kennecott Copper Corp. is well into the orebody at its open-pit mine at Ray, and Inspiration at Miami, plans development of a new open-pit project.

★Arizona's legislature has been asked to give all possible assistance in obtaining $30,000,000 in Federal money to **speed development of strategic minerals** in the state. Charles F. Willis, secretary of the Arizona Small Mine Operators Association urged that state facilities be made available to help operators qualify for Government loans. Additional field engineers working out of the Department of Mineral Resources would be required, he said.

ARKANSAS

★According to a U. S. Bureau of Mines report on **cinnabar deposits** in the state, mine dumps at mercury properties in three southwestern counties are estimated to contain about 36,000 lb. of recoverable mercury. Cinnabar is the principal ore mineral of mercury and is found in only a few states.

CALIFORNIA

★Some 295,000 acres of former Joshua Tree National Monument land have been opened to **prospecting and mining.** The acreage released when the President signed a bill Sept. 25, has been considered "most promising for all sorts of prospecting," including possible deposits of uranium and other strategic material.

★**American Potash & Chemical Corp.** has granted an average wage increase of 14c. to 1,000 of its 1,600 workers at Trona, Calif. The one-year contract with the Alkaline Salt Workers Union 414, affiliated with the IUMMSW, provides for wage increases ranging from 12 to 18c. an hour, effective Dec. 1, and grants improved vacation privileges and a union maintenance-of-membership clause.

★Tungsten mining is again active at the deep-pit **Surcease Mining Co.**, on holdings of the old Atolia Mining Co., near San Bernardino, Calif. Ore is found 70 to 80 ft. below the surface. During some 35 years of operation,

IN MINING

the mine has produced about $30,000,000 in tungsten ore. However, old shaft and drift methods proved too costly during a period between World War I and World War II, and mining operations were suspended. Since 1942, large-scale placer-type operations have made the mine active and it now operates on an increasingly productive basis. The company is doing hard rock mining in its deep placer pits, using a heavy dragline to handle the ore.

★One of the state's oldest copper and gold producers, the Copperopolis area, is yielding asbestos. Flintkote Co. is operating the Voorheis property, reported to contain a large deposit of commercial asbestos, following extensive exploration work, and installation of equipment.

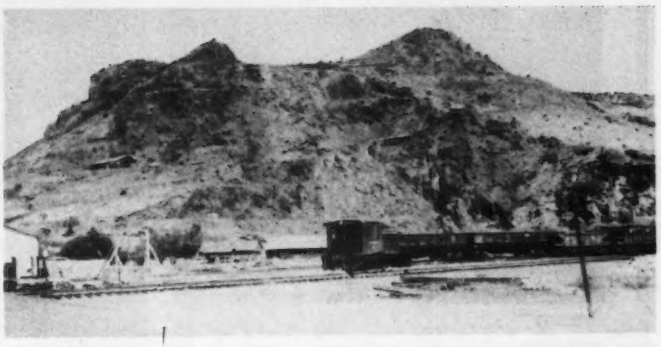
★**Idaho-Maryland Mines Corp.** has applied to the California Corporation Commission for permission to grant C. Marshall Wood, New York financier, options to buy 300,000 shares of treasury stock at $1 a share, par value. The company plans to use the funds to raise working capital for exploration and development at its Grass Valley mine.

COLORADO

★**Gold and silver receipts at the United States mint** in Denver for November continued above the 1949 rate. Receipts of gold for the month consisted of 57,277 oz. worth $2,004,703 compared with 46,171 oz. worth $1,615,908 in November, 1949. Silver receipts came to 13,145 oz. worth $11,768 compared with 11,460 oz. worth $10,251 a year before. Number of deposits was up to 142 from 132.

★**The manganese discovery on Ironclad Hill** at Cripple Creek looks like a tonnage proposition. The United States Geological Survey has had a crew looking it over and indications are that core drilling will be done to outline the additional depth and limits of the deposit, which has been indicated to have a depth of several hundred feet and to run several hundred feet laterally. Ironclad Hill got its name from the iron capping that has now been found to contain manganese, iron and lime.

★**With diamond drilling** going on at a rate of 300,000 to 400,000 ft. per year in the Colorado Plateau area, much has been learned about the best techniques suited to that area. At present eight contractors operating about 50 drills are active on the Plateau. Prospect drilling is now going on in Mesa, Montrose, and San Miguel Counties in Colorado and San Juan and Grand Counties in Utah.



HIGH-GRADE IRON ORE forms this mountain near Durango, Mexico. Cerro Mercado extends about 2 miles east to west and is about 1½ miles wide. It is one of Mexico's largest and best-equipped sources of iron ore.

★William E. Brewster, general manager of **Hanna Mines, Inc.**, operating the Cash mine at Boulder reports that his company has done considerable development work this year, sinking two shafts, doing drifting and stoping and shipping low-grade ore. New drills are to be installed. He has been mining ore with assays running from 2 to 8 oz. in gold and 20 to 50 oz. in silver. This ore is going to the smelter at Leadville.

★A new era for the **Cripple Creek gold mining district** was seen by mining men attending a meeting called by C. H. Carlton, mine manager of the Carlton interests, when treatment rates at the new mill and increased wages for mine workers were discussed. Max Bowen, vice president of Golden Cycle Corp., builder of the new milling plant in the district scheduled to start operation the first of the year, stated that rates at the mill would yield shippers a larger net return than those prevailing at the old mill at Colorado Springs. Gold will be paid for at the rate of $35 an oz. in contrast with the $33.50 per oz. rate in effect at the old mill. It was reported that the Carlton properties planned to increase wages for both underground and surface workers by at least 15% and that a 48-hour work week would be established.

★**Climax Molybdenum Company** directors declared a year-end dividend of $2 a share in addition to the quarterly payment of 25c., both payable Dec. 18. This brought the total for the year to $2.80 a share against 80c. in 1949. The year-end dividend totals $5,680,000.

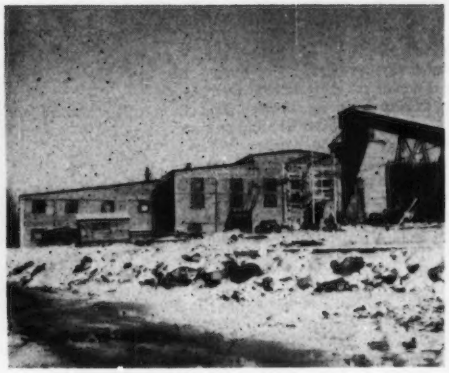
FLORIDA

★D. B. Kibler, Jr., manager of Kibler-Camp Phosphate Enterprise, Box 67, Lakeland, Fla., operating the Section 12 mine, at Dunnellon in the **Florida hard rock phosphate field,** states that the company's drying plant was moved some time ago from Fernandina to the mine. The reason was increasing freight rates. They now have wet and dry storage facilities at the operation. A Bucyrus-Erie 6W diesel-driven dragline with a 6-cu. yd. bucket has been bought to handle hard overburden which cannot be hydraulicked effectively. Output averages 80,000 tons a year, all going to one customer. No export business has been booked for 1951. This property was formerly operated under the name of C. & J. Camp, Inc., and J. Buttgenbach & Co., with Mr. Kibler as manager. The latter has acquired the interest formerly held by his Belgian partners.

GEORGIA

★Manganese ore has long been produced spasmodically in the **Cartersville area.** Most of the output has found its way to the steel companies of the Birmingham district. In the aggregate the quantity produced has been considerable. An undetermined tonnage remains. With the idea that, under present world conditions, all manganese ore that is available must be obtained, the Bureau of Mines has conceived a plan under which a central beneficiation plant would be established to serve the small manganese miners of Cartersville. The plan covers a possible assay office, stock-

MINE ORE comes out on this 30-in. conveyor to the coarse ore bin.



FINE ORE BIN and flotation plant of new 2,400-ton lead-zinc mill.

Conveyor From Underground Feeds Pend Oreille Mines' New Mill

PEND OREILLE MINES & METALS CO. began the New Year with three-shift operation in the first unit of its new 2,400-ton lead-zinc concentrator near Metaline Falls, Wash. W. L. Zeigler, general manager, reports that the plant is running smoothly. The manpower situation, for the present at least, is good.

The new plant is particularly notable for its direct connection to the mine through a 30-in. belt conveyor. Ore is crushed underground to minus 2-in., and then rides out to the mill up a 1,400-ft. conveyor in a 17-deg. inclined shaft. (See also E&MJ, July, 1949, p. 104.)

The mine conveyor leads to a 1,200-ton circular concrete storage bin. A 200-ton bin is also provided for ore that comes from above the main incline. It is crushed on the surface.

Belt feeders, equipped with Varidrive, carry ore from the primary bin to an Allis-Chalmers 60-in. Hydro-cone crusher in closed circuit with a ¾-in. vibrating screen. Crushed ore goes to the secondary bin, also a 1,200-ton circular concrete structure.

Fine ore goes to the ball mills over a belt feeder, also equipped with Varidrive. The ball mill is a 10x8-ft.. Union Iron Works with spun steel spherical heads. It runs in closed circuit with a Dorr Type H 7x28-ft. rake classifier. Lead roughers include eight Fagergren 56-in. cells. Lead rougher tails are reground in a 7-4-ft. conical ball mill closed with a 60-in. Wemco spiral classifier.

From the regrind circuit, ore goes to the zinc roughers, including ten Fagergren 56-in. cells. Cleaning circuits include: two 56-in. Fags for lead, and four 56-in. Fags for zinc (double cleaning in two cells each).

Final lead and zinc concentrates are thickened in 30-ft. Dorr thickeners, and filters in six-leaf and eight-leaf 6-ft. Eimco filters, respectively. Pulp and concentrates are handled by Hydro-seal Type B and Wemco sand pumps.

Two more 800-ton mill units are to be built as soon as new orebodies have been brought to production on the 1,700, the 1,900, and the 2,000-ft. levels of the mine.

Georgia *(Continued)*

piling of ores received and custom treatment. The questions as to who would build the plant and who would operate it are being studied.

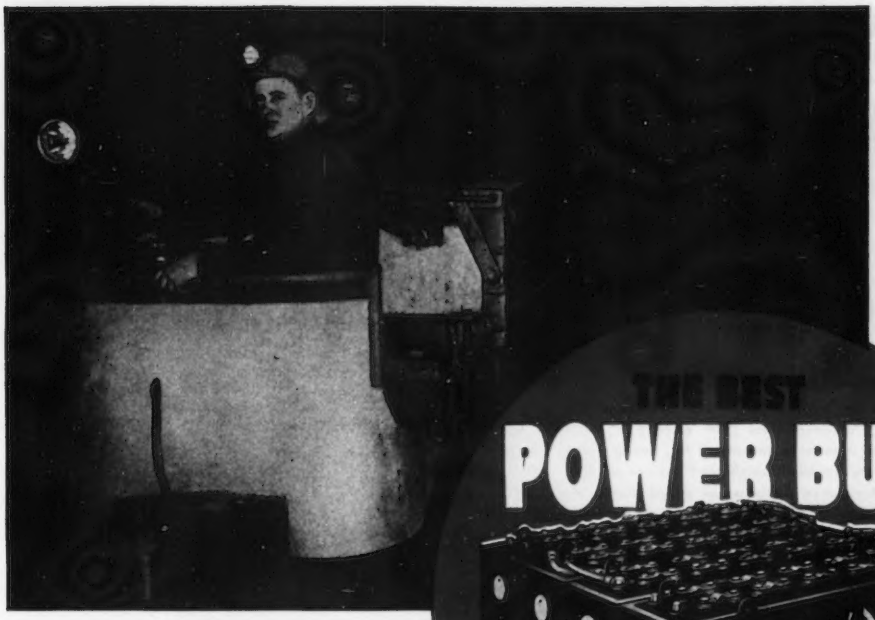
★**Deeper drilling for bauxite** is being done at Adairsville in Bartow County, by two large companies. The area is adjacent to one drilled by the Bureau of Mines during World War II. Bauxite of abrasive grade carrying about 2% iron and 2½% silica is said to have been located under about 100 ft. of clay.

★New Riverside Ochre Co., Cartersville, is **mining and beneficiating barite ore,** making just one grade of concentrate running 97.5 to 98% $BaSO_4$ with only 0.4 to 0.6% Fe_2O_3. Its output is sold to Chemical Products Corp., Cartersville. The New Riverside company is also doing business in ocher, making two grades, one running 58 to 60% Fe and 99½% minus 325 mesh and the other running 52 to 53% Fe and 92½% minus 325 mesh. This ocher finds utilization in making linoleum, mortar color, paint, stock feed and waterproofing. J. R. Dellinger is president of New Riverside and W. B. Hawkins, Jr., general manager, both of Cartersville.

New Riverside has rebuilt its table plant for recovery of barytes fines. The plant has been operating as close to capacity as weather has allowed. Increased demand for barytes has resulted, in part due to the step-up in the national defense program. The company is planning to start exploratory work on new deposits. The rehabilitation program of the J. R. Dellinger barytes properties at Tiff, Mo., now complete, has resulted in increased production of high-grade ore. The company does not anticipate reopening its barytes properties in Tennessee.

★Grinding is the main function of

(*Continued on page* 152)



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PERSONAL NEWS

RECENT CHANGES at Tennessee Coal, Iron & Railroad Co. include the retirement of Robert Gregg (left), president since 1938; election of Arthur V. Wiebel (center), vice president in charge of operations, to succeed Mr. Gregg, and the election of John Pugsley (right), comptroller, to the newly established position of executive vice president. Other promotions in this steelmaking subsidiary of United States Steel Corp. are that of J. M. Spearman, manager of manufacturing operations, who succeeds Mr. Wiebel as vice president in charge of operations, and Hartwell A. Greene, successor to Mr. Pugsley.

Charles A. Mitke, who has been developing mining properties in the Philippines, recently returned to New York after spending three months investigating mining conditions in India and Turkey.

James R. Stringham, who graduated last spring from the Colorado School of Mines, is working as junior engineer for Cia. Minera Asarco, in Mexico.

Francis Kernan, a partner of White, Weld & Co., has been elected a member of the board of directors of Freeport Sulphur Co.

S. Power Warren has temporarily discontinued his consulting work and is now with the evaluation branch of the production and expansion division of the Defense Minerals Administration in Washington, D. C. He is located at 6617 Willston Place, Falls Church, Va.

W. C. McKenzie, chief engineer of the ore mines division of Tennessee Coal, Iron & Railroad Co., has been elected chairman of the Southeast Section of the American Institute of Mining & Metallurgical Engineers.

E. H. Rose, research engineer of TCI, was named first vice chairman; **A. M. Shook, III.,** general manager of mines of Shook & Fletcher Supply Co., was named second vice chairman, and **W. L. Dowdey,** manager of southern division of Eimco Corp., was elected secretary-treasurer. **W. C. Chase,** Alabama By-Products Co., is retiring chairman.

Leon D. Keller has been transferred from the Westport, Conn., Research and Testing Laboratory of The Dorr Co. to St. Paul, Minn., where he is acting as the central industrial sales representative for the company in that area.

Lloyd W. Strayer, chief civil engineer of the Pittsburgh Limestone Co., has retired after serving the company for 31 years. He will continue to act in the capacity of consulting engineer.

Thomas C. Hedlund has resigned as mine shift boss at Telluride Mines, Inc., Telluride, Colo., to accept a position as mining engineer for the U. S. Vanadian Corp. at Uravan, Colo.

Walter H. Myers, president of the U. S. Grant Mining Co., Virginia City, Mont., has been re-elected head of the mining division of the Montana Safety Council. **Oscar A. Dingman,** professor at the Montana School of Mines, was re-elected secretary, and **John L. Boardman,** director of the safety department of Anaconda Copper Mining Co., was elected a director.

W. T. Irvine has been made senior mine geologist for Consolidated Mining & Smelting Company of Canada, Ltd. He will have charge of all the company's operating mines in British Columbia, except the Sullivan. Mr. Irvine joined Cominco's geological staff in 1946, after serving with the Britannia Mining & Smelting Co.

Roger O. Oscarson, Spokane mining engineer, has resigned as secretary-manager of Northwest Mining Association, to become head of a Department of Commerce field service office in Spokane.

Henry J. Petrie, New York City, has been appointed instructor in mining at Lafayette College, Easton, Pa. He was previously with the Worthington Pump & Machinery Corp.

John Evenoff, mining engineer at the Hill-Annex mine of the Interstate Iron Co., has been transferred to the company's engineering department at Virginia.

R. G. McEachern has been appointed assistant to the chief geologist for Consolidated Mining & Smelting Co. of Canada. He graduated in geological engineering at the University of British Columbia and joined the staff at Cominco's Sullivan mine in 1942 as assistant geologist. He became sub-district geologist for the Kimberley area in 1945 and was appointed sub-district geologist for southern B. C. in 1949.

L. F. Pett has been named general superintendent of mines for the Utah Copper Division, Kennecott Copper Corp. He joined the company in 1922 following graduation from the University as clerk and has served successively as clerk in the engineering department, safety engineer, general mine foreman and assistant mine superintendent.

W. H. Goodrich, general manager of Chino Mines Division, Kennecott Copper Corp., at Hurley, N. M., and president of the New Mexico Miners & Prospectors Association, has been appointed state chairman of the New Mexico Payroll Savings Committee.

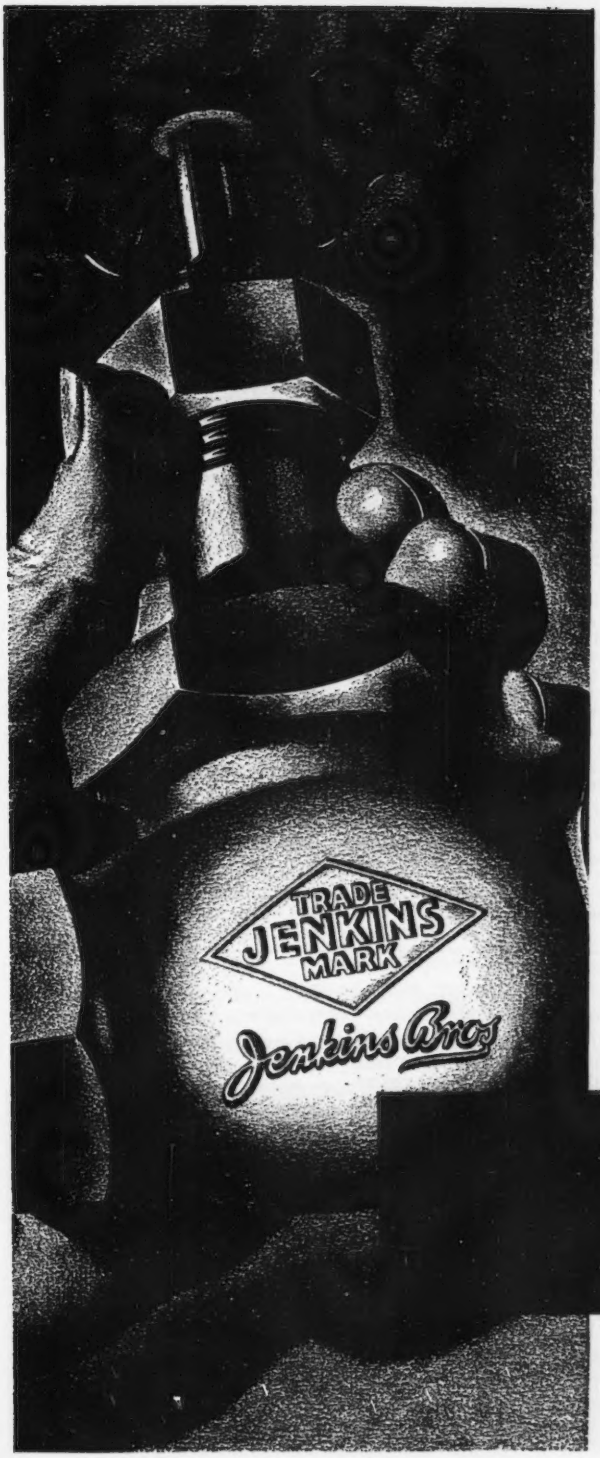
Oscar A. Glasser has been appointed assistant to the vice president and general manager of western operations of the United States Smelting, Refining & Mining Co. Since 1942 he has been industrial relations manager of the company's operations. He will be succeeded in that position by **M. A. Kuryla. B. E. Grant** has been named assistant manager of western mines for USSR&M.

W. C. Page, vice president and general manager of western operations for the United States Smelting, Refining & Mining Co., has been chosen as the 1951 president of the Utah Mining Association. He succeeds **Paul H. Hunt,** vice president and general manager of Park Utah Consolidated Mines Co.

Albert B. Needham, chief of the U. S. Bureau of Mines Mining Division for Region V at Minneapolis, Minn., has been appointed to head a team that will determine the feasibility of Federal aid to private industry for exploiting promising mineral deposits in the Upper Midwest essential to the defense program. Carl E. Dutton, regional geologist for the U. S. Geological Survey at Madison, Wis., will work with Mr. Needham.

Jack White is in charge of all milling operations at the Kilembe mine, Uganda, which is in the development stage and is being investigated by Frobisher, Ltd. He was formerly with Mufulira Copper Mines.

Edward W. Luthy, who graduated from the Colorado School of Mines last May, is located at Gilman, Colo., where he is in the engineering depart-



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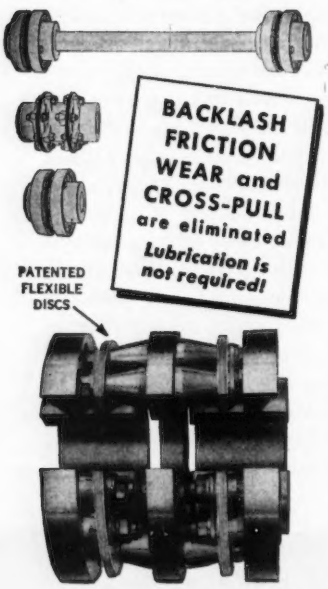

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ED CRABTREE

ED CRABTREE, Eagle Picher's well-known director of milling, is distinguished in the ore-dressing field for his excellent ability to obtain optimum results by a rare combination of theoretical knowledge, practical skill and the ability to get on with people.

At the present time he is headquartered in Miami, Okla., and is in charge of the Eagle-Picher mills in Mexico, Arizona, Illinois, and the Tri-State district, where the Central Mill is located. This is one of the largest lead-zinc concentrators in the world.

A native of Montana, Crabtree is a graduate of the Colorado School of Mines. Following his graduation, he went to work for Eagle-Picher at Picher, Okla., and for two years worked successively as underground mucker, mill helper, and in 1929, as assistant mill superintendent of Consolidated Lead & Zinc Co., an Eagle-Picher subsidiary. He then left the company to work for the Canam Metals Co., a newcomer to the Picher field, as mill superintendent in charge of 12 mills. With the advent of the depression in 1931 and the consequent closing of lead-zinc mines, he moved to Poplar Bluff, Mo., as mill superintendent for the Southern Mining Co., operating an iron ore washer. A year later, when this operation shut down due to lack of an iron ore market, he again moved, this time to Nevada, Mo., where he was in charge of a rock asphalt plant and did general contracting work until 1935.

With increasing metal prices, Eagle-Picher started their lead-zinc operation at Ruby, Ariz., and engaged Crabtree as mill superintendent for this operation, where he remained for five years. In 1940 this mine was exhausted and he resigned to accept a position as metallurgist for the Arizona Bureau of Mines at the University of Arizona. During the following two years he was extensively engaged in ore testing and consulting work on many different types of metallic and non-metallic ores.

In 1943, Eagle-Picher employed Crabtree as consultant for a new Arizona operation they were starting which involved design and construction of a 500-ton lead-zinc concentrator at Sahuarita, Ariz. This soon led to another full-time employment with the company as chief metallurgist, and advancement in 1947 to the position he now holds.

He has published several technical papers on ore dressing and is active in the Mineral Beneficiation Division of AIME. During 1950 he was regional vice chairman of the division.

ment of the Empire Division of the New Jersey Zinc Co.

M. O. Scott, assistant purchasing agent for Anaconda Copper Mining Co. for the past 10 years, has retired. He has been succeeded by his assistant, **Frank W. Switzer.**

Howard Lee Young has been promoted to the position of assistant manager of sales for The American Zinc, Lead & Smelting Co. and the American Zinc Sales Co., succeeding the late **Frederick W. Knoke.** His headquarters will be in St. Louis, Mo.

Frank S. Barnard, assistant superintendent of milling operations at the Idaho-Maryland mine, Grass Valley, Calif., since 1947, has been named superintendent. He succeeds **Richard Krebs,** who has resigned.

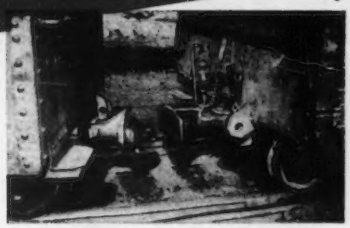
Charles Baxter, formerly with the Castile Mining Co. at Ramsey, Mich., is now chief engineer at the St. James mine, Aurora, which is operated by Oglebay, Norton & Co.

Waldemar F. Dietrich, senior member of Dietrich, Morse & Associates, consulting engineers of Sacramento, Calif., has been appointed chief of the Rare and Precious Metals Branch of the Minerals Division, U. S. Bureau of Mines. He has been in Washington since last July as a mining engineer consultant in the Bureau's Base Metals Branch.

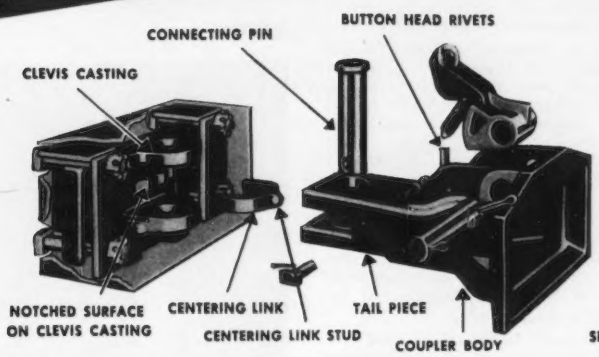
William Wittmeyer, of Minneapolis, who has been with the U. S. Bureau of Mines, has resigned and opened an office for private engineering work at Marysvale, Utah.

R. M. Belliveau, Hibbing, district superintendent of Cleveland-Cliffs Iron Co., has been promoted to general superintendent in charge of open-pit and underground Mesabi range mines.

Get Speed In Your Haulage With Couplers That—



Automatic Self-Centering keeps these coupler heads in position to join on impact.



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Self-centering O-B Automatic Mine Car Couplers speed up mine car haulage. With old-fashioned couplers a man is needed to guide the heads together, and to make the connection between them. Self-centered couplers come together securely—surely—by themselves.

Parts of the self-centering mechanism are shown in the illustrations here. Rivets passing through the coupler body hold a spring compressed against a spring core. The square core end is recessed to receive a stud on the centering link which bears, at its tips, on a notched surface on the clevis casting. When the coupler tail piece is joined to the clevis by the connecting pin, the link stud presses against the core; depresses the spring. As the coupler head is moved off center, the link rocks on either tip and compresses the spring still further. Thus when the head is released, the link is forced by the spring to pivot about its tip until the head is centered again.

This is how unengaged O-B Automatic Couplers are kept in alignment with the mine car centerline at all times. Self-centering is one of several features in the O-B Automatic Coupler. We'll be glad to show you how these couplers help deliver more coal at the tipple in a given time, and put more economies into your operating method at the same time. Write for more information.

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Harold M. Wright, metallurgical engineer of Vancouver, B. C., is the new chairman of the B. C. section of the Canadian Institute of Mining & Metallurgy for 1951. Other officers of the B. C. section include: **L. G. R. Crouch,** associate professor of metallurgy at the University of B. C., first vice chairman, and **Dr. J. E. Armstrong,** of the Geological Survey of Canada, as second vice chairman. **Dr. Christopher Riley,** chief geologist of Pioneer Gold Mines of B. C., Ltd., is new chairman of the Vaucouver branch of the CIMM.

ARTHUR C. BIGLEY, general superintendent of mines for Anaconda Copper Mining Co., has been appointed manager of mines. Edward J. Renouard, Jr., assistant general superintendent of mines, succeeds him. Mr. Bigley has served the company in various capacities for the past 37 years. He was assistant general superintendent of mines for seven years, and became general superintendent in September, 1947. Mr. Bigley succeeds H. J. Rahilly, who has reported to the mining department of the company in New York.

C. T. Ulrich, chairman of the executive committee of Kennecott Copper Corp., has retired. He will continue as a director of the company.

James C. Gray, assistant manager of raw materials for the Tenneessee Coal, Iron & Railroad Co., has been appointed manager of manufacturing operations. He succeeds **J. M. Spearman,** who has been made vice president in charge of operations. **Elmer F. Harris,** assistant general superintendent at the Fairfield Sheet and Tin Mills, has been appointed assistant manager of manufacturing operations. **John R. Hunt,** superintendent of the Fairfield Sheet Mill, succeeds him.

Tell Ertl, former mining engineer with Union Oil Company of California, is now professor and chairman of the mining engineering department of Ohio State University. **Prof. H. E. Nold,** who has been chairman of the department for many years, will continue to teach until his retirement.

Alan F. Sheldon has been elected president of Kennecott Wire & Cable Co., a subsidiary of Kennecott Copper Corp., to succeed **Robert L. Coe,** who has retired.

James Douglas, secretary of Phelps Dodge Copper Corp., has resigned to become Deputy Administrator of the Defense Minerals Administration in Washington, D. C. Mr. Douglas served with the War Production Board during the last war in various capacities from March, 1941, until Sept., 1945. He was successively: analyst in the copper zinc division, chief of the nonferrous branch, mining division, director of the zinc division, and deputy vice chairman for metals and minerals.

V. A. Brussolo, consulting mining engineer, of Manila, P. I., passed through New York recently on his way to South America, where he will visit Colombia, Equador and other countries.

OBITUARIES

James Ralph Finlay, who operated mining properties in the West prior to his retirement in 1932, died in Redlands, Calif., Jan. 2. He was a former president of the American Institute of Mining & Metallurgical Engineers.

Stanley M. McDonald, 35, chief geologist and assistant general manager of Louisiana Land & Exploration Co., died Dec. 11, in Midland, Tex.

Percill Liddicoat, widely known in mining and industrial circles both in Canada and the United States, died in Toronto in November. He had been in charge of the research and development of the mining division of Thompson Products, St. Catherines, Ont., and also headed that division in the Calumet, Mich., and Salt Lake City, Utah, plants. He was the inventor of the Liddicoat detachable rock drill bit.

Frederick W. Knoke, assistant manager of sales for the American Zinc Sales Co., died Dec. 25. He joined the company in 1920 and was made Western district manager a few years later. In 1930 he was made assistant manager of sales.

Dr. Francis A. Thomson, who retired from the presidency of the Montana State School of Mines Oct. 1, 1951, died Jan. 11 in Spokane. He came to British Columbia from London in 1886, received his degree in mining engineering from the Colorado School of Mines in 1904, and served as dean of the School of Mines at Washington State College from 1908 to 1917. In 1928 he was named president of the Montana school after serving as dean of the University of Idaho School of Mines.

Harry U. Maxfield, 88, former president of the California Metal & Mineral Producers Association, died Dec. 7 in Oakland, Calif. He was president of the Sixteen To One Mine, Inc., in Sierra County, for 45 years.

Dr. Chester Stock, 58, recently elected president of the Geological Society of America, and chairman of California Institute of Technology's Division of Geological Sciences, died in Pasadena, Calif. From 1943 to 1945 he served as senior geologist with the U. S. Geological Survey.

Louis Carlton Sabin, former vice president of the Lake Carriers Association, died Dec. 30 in Cleveland. He was 83. From 1925 to 1948, when he retired, he was the association's expert on matters of channels, charts, locks, water levels, dams, drafts and other navigational matters.

LETTERS

. . . The December Cover

Dear Sir:

As I was one of the first ten men to carry a carbide lamp in the Leonard mine at Butte, I fully qualify as one of the 10% that you estimate may recognize the device holding the candle on your lovely, nostalgic cover. I still have such a candlestick.

I wonder how many of that 10% will recall what is meant when I say the cover is "brev and fitty."

DAVID A. HOFFMAN

Seahurst, Wash.

Gentlemen:

It is interesting to note the miner's candle holder on your cover page of this month's Journal. It is a replica of one which belonged to my late husband, which he used for many years underground, jabbing it into a vein or hanging it on a rock. We also used it in and around the cabin. It was made out of a Spanish American sword, with which he jabbed a Cuban to save Col. Teddy Roosevelt's life.

My husband served in Troop A, 1st Regiment, U.S.C. Volunteers, "Rough Rider" Aide de Camp to Col. Roosevelt in Cuba. He was later appointed as collector of internal revenue for New Mexico and Arizona. He was offered many political positions, but refused, and of course, with the call

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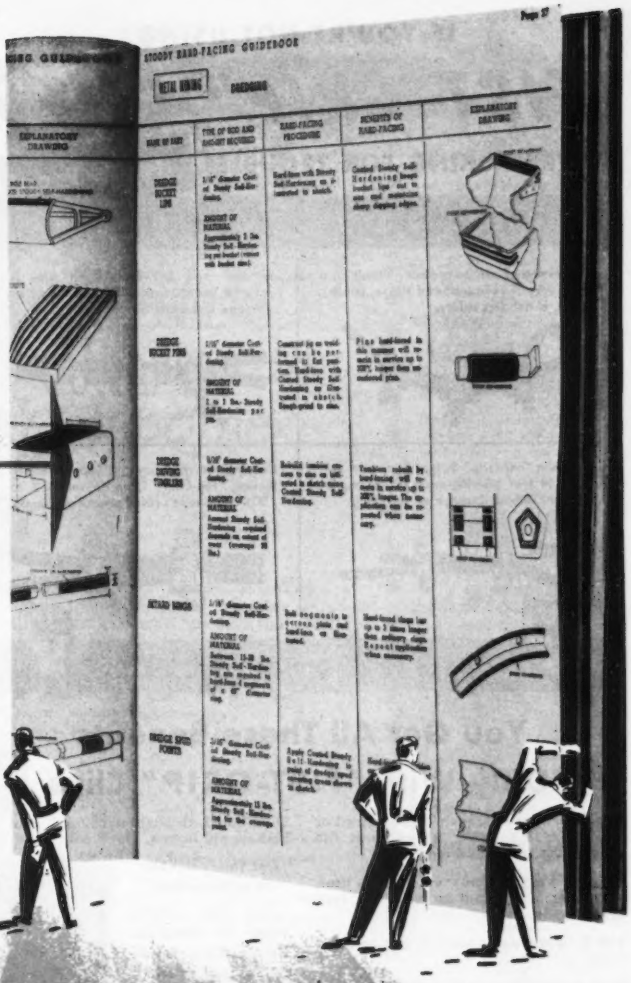

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of the wild in his blood, took up his most loved work, mining. At his death in September, 1946, he owned and operated the Greenhorn Caves mine. . . .

MRS. HENRY P. BARDSHAR

Los Angeles, Calif.

Dear Editor:

. . . I wonder if the illustrated cover (which is a really beautiful bit of work) on the December issue of *Engineering & Mining Journal* is not completely a drawing. I have saved several of those old candle holders taken from mines unwatered after being idle for from 30 to 40 years and have saved some from old mines and prospects which never saw any but drinking water; some with stubs of candles still unburned and some empty. Some were clearly made by the mine blacksmith and some most surely bought from a supply house.

BUT I never saw one with square iron (possibly Norwegian iron) for the long point, hex iron for the handle and apparently round iron for the hook.

C. A. DYE

Salt Lake City, Utah

Editor's Note: A drawing was made, using a candlestick belonging to one of the staff members as a model.

Dear Sir:

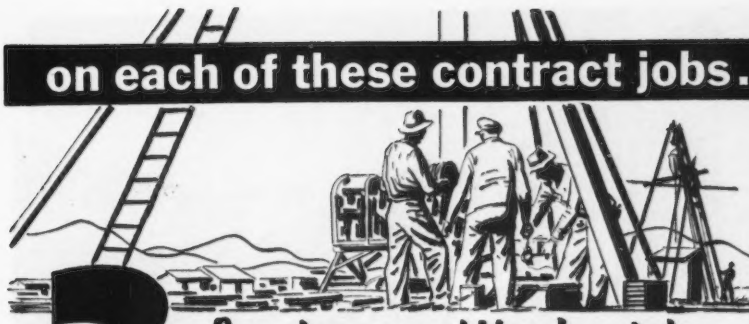
I found the unique windlass (shown in the photograph) over an old prospect shaft not far from here. You will notice that the drum of this "hoist" consists of the trunk of a small spruce, with the bark removed at the journals. The handle is made out of two saplings nailed together and to the drum, and a piece of the old hemp rope still remains in place near the handles.

The ancient miner evidently stood upon a small platform across the shaft and applied the necessary power to the handles, and then dragged the bucket of muck along the platform to the dump, by which my daughter is standing.

S. A. PAIN

Swastika, Ont., Can.

on each of these contract jobs...



3 factors will decide the final outcome

Equipment

We make it! We manufacture a complete line of modern diamond drills—underground and surface models, compressed air, gasoline or diesel power. Capacities range from 200 to 5000 feet. We also manufacture hundreds of auxiliary items—everything from core splitters to 60-foot derricks. We are exclusive manufacturers of PERMASET diamond bits and reaming shells—available in all standard sizes and in a multitude of patterns developed to penetrate every known formation with speed, economy and maximum core recovery.

Experience

We have it! During the last 20 years, Boyles Bros.' crews have successfully completed more than 2000 contracts in mining areas throughout the world. As a result of this wide experience we have developed equipment, techniques and procedures to cope with every formation, every transportation and climatic problem likely to be encountered on drilling operations anywhere.

Efficiency

We maintain it! Once begun, no Boyles Bros. drilling program is ever halted for want of men, equipment, bits or parts. Crews are handpicked for experience, dependability and local knowledge; they operate under expert supervision at all times. With strategically located branches and subsidiary companies, we are equipped to render real service in core or blasthole drilling, foundation tests, soil sampling, oil well structure drilling and other related problems. For information and quotations, submit your requirements to our head office at 1291 Parker Street, Vancouver, B.C.

SCOTLAND—Foundation testing.
Hydro Electric Board of Scotland, Loch Fannich, Ross-shire.

INDIA—Gold core drilling.
Mysore Gold Mining Co., Ltd., Marikuppam, India.

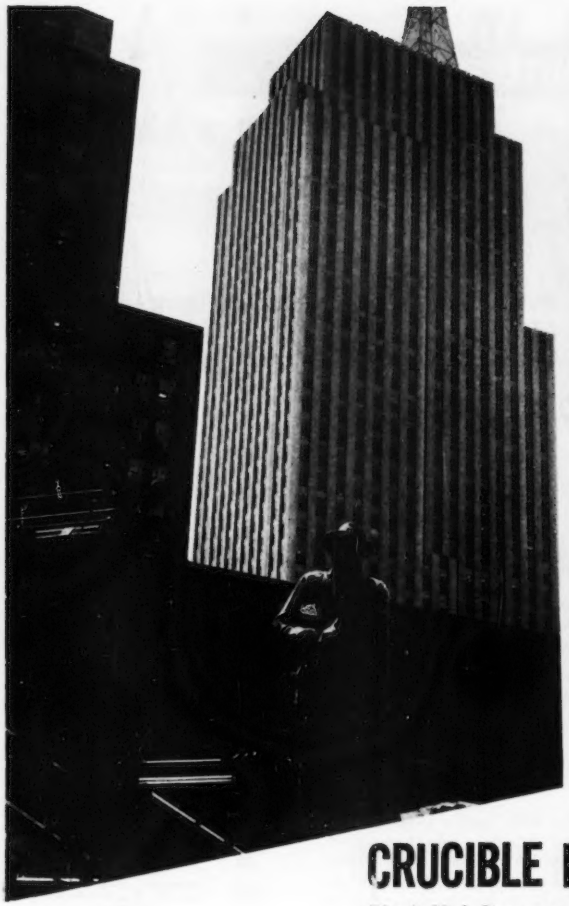
FRENCH MOROCCO—Base metal core drilling.
Mines de Bou Skour, Ouarsasate, French Morocco.

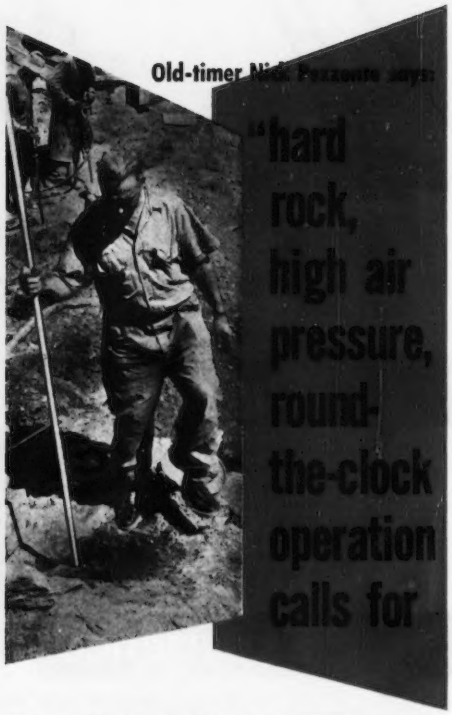
BRITISH GUIANA—Sampling.
Demerara Bauxite Co. Ltd., MacKenzie, British Guiana.

CANADA—Core drilling.
Steeprock Iron Mines, Atikokan, Ont.

...all three work constantly for you on every contract job we do.

BOYLES BROS
DRILLING COMPANY LTD.
VANCOUVER, CANADA



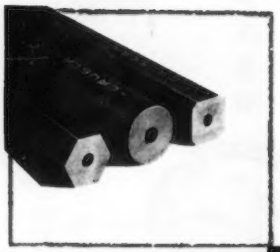


CRUCIBLE HOLLOW DRILL STEELS!"

That's Nick Pezzente, Blaster, Slattery Contracting Company, Inc., tapping a charge in the big hole for the new Chrysler Building Annex in New York City. Slattery Contracting does a major portion of the rock work around the New York metropolitan area, and Nick's an old hand at knowing by experience what it takes in drill steel to do the best job at *lowest cost per foot drilled.* He's been in this business for more than 25 years.

When the job calls for holing out hard rock, that's where Crucible *pretested* Hollow Drill Steels stand up and take it. Fewer lost bits—Crucible Hollow Drill breakage is cut to a minimum by gruelling tests on *every* lot before it gets to you.

And you get an extra when you do business with Crucible—our metallurgists and drill steel specialists can help you with those "special" jobs that take something different in drill steels. CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N. Y.



CRUCIBLE first name in special purpose steels

51 *years of* *Fine* *steelmaking*

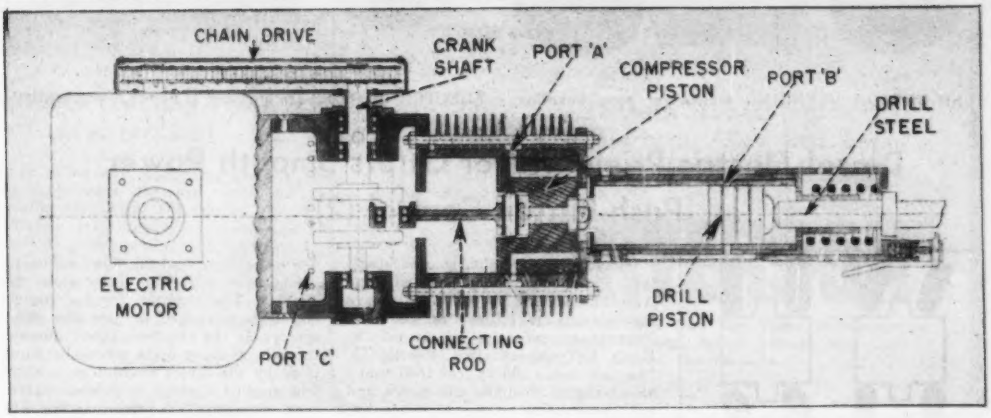
HOLLOW STEEL DRILL

HIGH SPEED • TOOL • STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

E & M J

NEW PRODUCTS DIGEST

For further information on these products, circle item numbers on card—insert and mail.



PREVIEW

New Electric Drill Contains Compressor

O. F. SPARANO, INVENTOR, left, observes drill operator try out electropneumatic model during recent demonstration. (Pat. applied for.)

A NEW ELECTROPNEUMATIC HAMMER suitable for secondary blasting in open pits, quarry work, tie tamping and construction and demolition jobs was recently demonstrated for McGraw-Hill editors and contractors in New York by Ottorino F. Sparano, Italian inventor.

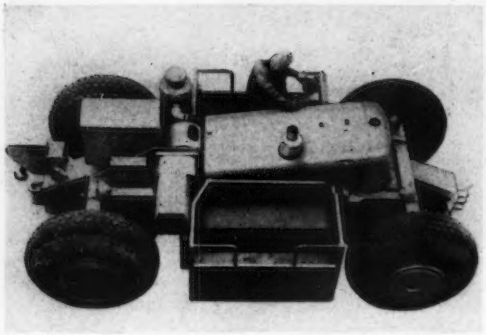
The drill-hammer is unique because it combines compressor and drill in one unit, thus eliminating the need for pipe lines, hoses and a separate compressor.

This is how the drill operates (See drawing.): A 1.5-hp. 220-v. electric motor drives a compressor piston through a chain drive, crankshaft, and piston rod. The reciprocating movement of the compressor piston is transmitted pneumatically to the drill piston which drives a drill steel or other pneumatic tool.

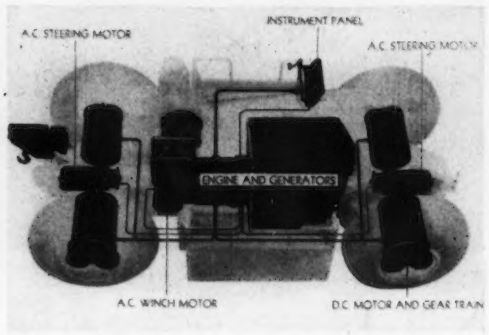
No valves are required. A careful study of ports "A" and "B" will reveal how air is admitted or exhausted from the cylinders to permit the drill to operate effectively. Ports "C" prevent any back pressure above the compressor piston. Note also that when the drill is inoperative (i.e., when the drill piston is not bearing down on the drill shank) the drill piston drops to the bottom of the cylinder. This automatically opens port "B" which permits the compressor to idle freely against neutral pressures on either side.

Advantages of the experimental model of the drill noted during the demonstration were as follows: Low power consumption; smooth, quiet operation; very little shock transmitted to the operator's arms because of the spring construction at the end of the small cylinder.

Exclusive rights for the manufacture and development of this unit in U. S. A. are held by O. F. Sparano, New York, N. Y. For further information on this drill circle No. 1 on the reply card opposite page 150.

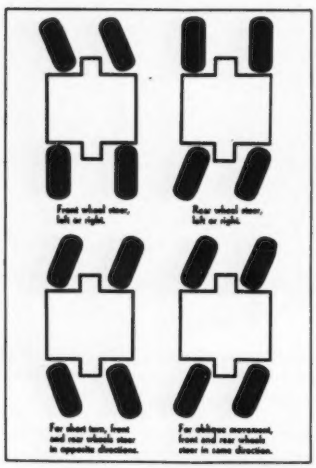


PUSH-BUTTON STEERING makes for easy handling.



ELECTRIC MOTORS are mounted at points of application.

Diesel-Electric Prime Mover Offers Smooth Power, Push-Button Control (2)

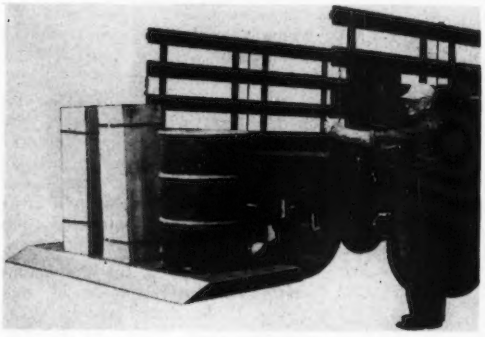

Front wheel steer, left or right.
Rear wheel steer, left or right.
For short turn, front and rear wheels steer in opposite directions.
For oblique movement, front and rear wheels steer in same direction.

PUSH-BUTTON CONTROL, smooth starting, a smooth, steady pull with no transmission and no differential are the advantages offered by the new Tournatow, recently announced by R. G. LeTourneau, Inc., Peoria, Ill. The unit uses a 186-hp. (at 1800 rpm.) diesel engine to drive one direct and one alternating current generator, which supply power for all steering, forward, reverse and lateral movements of the machine, and the operation of the winch.

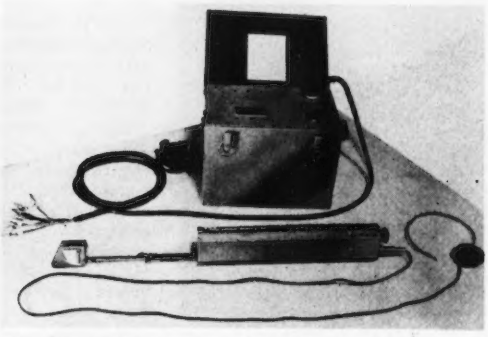
Connection between the Tournatow's power plant and the motors, driving steering and winch, is through flexible electric conductors and the motors are placed at their points of application. This eliminates the necessity of intermediate and final drive gears and shafts, of differential, transmission, universal joints, hydraulic braking system and other mechanical gearing and linkages, normal in 4-wheel drive, 4-wheel steer vehicles.

Operation of the Tournatow is simple. The throttle for its diesel engine is advanced to turn the generators at the required speed. Power to each of the 4 drive wheels is supplied by the direct current generator and applied through a potentiometer type rheostat for precision control. The alternating current generator supplies power to each of the 2 motors used to steer the front and rear wheels and to the motor operating the large capacity winch in the rear of the unit. This power is controlled by individual switches mounted on the control panel.

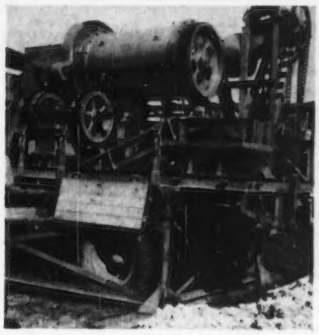
Large scale production of the Tournatow will occur when certain critical war materials such as copper become more plentiful. Further information can be obtained by circling No. 2 on the postage-free reply card, opposite p. 150, and mailing.



HYDRAULIC ENDGATE for van cargo or platform truck lifts 2,000 lb., has unobstructed platform for front side loading. Comes in 4 sizes up to 90 x 34 in. Gar Wood Industries, Inc., Minneapolis, Minn. (3)



FAULT FINDER permits quick location of short circuits and open-type faults in electrical cable. Unit requires no technical training or complicated calculations to operate. Works on batteries. Joy Mfg. Co. (4)



Portable Crushing Plant

The Victoria Department of Mines in Australia may replace 28 stationary crushing stations serving prospectors throughout the state, with one portable unit of its own design.

Shortly after the late unlamented war department officials realized that long periods of idleness plus the effects of weather and vandals made the stationary plants impractical. Studies indicated that a portable plant would be satisfactory and Austral Otis Engineering Co., Ltd., took up the job.

Plans call for the following units:

(1) 8x5-in. Roll jaw crushers.

(2) Marcy ball mill.

(3) Rotary spiral wire screen.

(4) 60 x 33-in. amalgamating table.

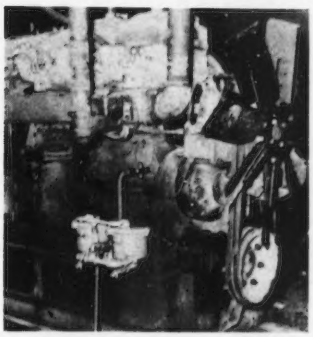
(5) No. 5 Wilfley concentrating table.

(6) Small amalgamating barrel for cleaning up concentrates.

(7) 400-gal. water tank and centrifugal pump.

(8) 30-hp. Southern Cross diesel engine to power all units.

All the units are assembled on a 20 x 8 ft. semi-trailer. For more information circle No. 5 on reply card.



FILTER is a chemically activated unit that cools the circulating liquid in gasoline and diesel engines while filtering it. Spark-O-Liner Corp., Minneapolis, Minn. (6)

STEEL

Prompt Shipment . . .

Some products are in short supply but when shortages occur we can often supply practical alternates

Plates, Structurals, Bars, Sheets, Tubes, etc. . . . Carbon, Alloy and Stainless Steels . . .

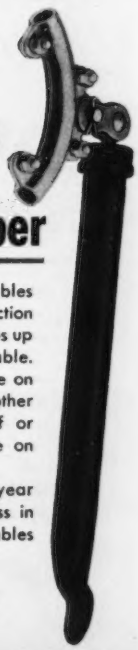
RYERSON

Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco

STOP CABLE BREAKS

with the

MESCO Shock Absorber



The MESCO Shock Absorber "dead ends" trailing cables and allows for slack when connecting cables to junction boxes or other sources of power. A strong spring takes up sudden jerks or load pulls which might snap the cable. Equipped with a four bolt clamp (illustrated) for use on shuttle cars, or with a hinge type clamp for use on other mine machinery. Can be securely bolted to roof or chained to timbers or rails. Recommended for use on electrical, hydraulic, or clutch driven reels.

The MESCO Shock Absorber was introduced last year and already is being used with outstanding success in scores of mines. Save costly splicing time on your cables —investigate the MESCO Shock Absorber today.

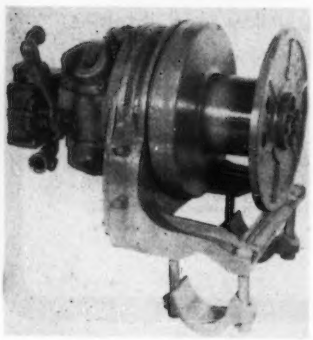
MOSEBACH ELECTRIC & SUPPLY CO.
1117 Arlington Ave., Pittsburgh 3, Pa.
HEmlock 1-8332

"A COMPLETE LINE OF RAIL BONDS AND OTHER TRACK AND TROLLEY PRODUCTS FOR THE MINING INDUSTRY"

Sighting Device, Simple Construction Feature Transit (7)

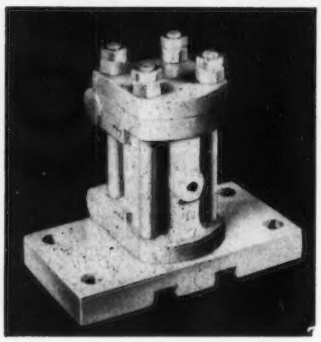
The microptic transit is a compact, lightweight instrument designed for elementary surveys in mines. It can be used as a trigonometric level or as a simple theodolite for surface work. It's easy to carry, simple in operation and does not require extensive training for use. Horizontal and vertical circles are divided directly to 5 min. and there is no difficulty estimating to 1/5 division on the 3-in. diameter circles. The circle reading microscopes are self-contained units with ground glass windows providing diffused illumination.

For sighting a parallel plate of glass is placed in front of a collimating lens and inclined at 45°. In the first focal plane of the collimator lens is an opaque graticule disc with clear sighting lines which transmit light. The observer sees a reflected image of the illuminated graticule superimposed on his field of view corresponding to the graticule in an ordinary telescope. Collimator adjustments are easily made. Hilger & Watts Ltd., London, is the maker. Circle No. 7 on the reply card opposite p. 150 for more information.



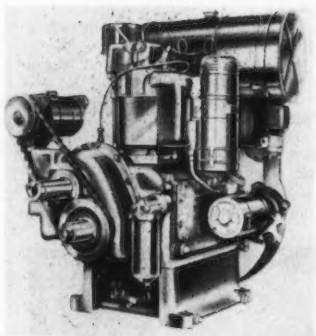
PORTABLE HOIST designated DW-111 Pistonair reversible hoist, is a 3½-hp. air operated unit with an automatic safety brake. Can easily be mounted on a post. Joy Mfg. Co., Pittsburgh, Pa. (8)

BIN VIBRATOR features no impact of the piston on either end; no metal to metal pounding; no springs; no ear-splitting noises. Uses heavier pistons, longer stroke than can be used on heavy duty impact-type vibrators without breakage. Cannon Vibrator Co., Cleveland, Ohio. (9)



PORTABLE WINCH-HOIST has 1½-ton capacity, weighs 8½ lb. and is fully tested to a 100% overload. Called Lug-All, it uses pre-formed flexible aircraft cable, stainless steel fittings. Locking is positive and automatic. Price: $33.50. Lug-All Co.

DIESEL ENGINE, developing 20 hp. at 1800 rpm., is most powerful air-cooled diesel yet placed on the market. A 2-cylinder 4½ x 4½-in. unit, it uses .38 lb. oil per bhp. per hr. Sold and serviced by Lister-Blackstone, Inc., N. Y. (11)



LENS TISSUE for goggles and glasses in the plant, laboratory or engineering office are low cost, large size, silicone treated tissue available in an easily filled dispenser. Silicone Paper Co. of America, Inc., New York, N.Y. (12)

FUNGICIDE SOLUTION, trade-named "Sani-Mist," will protect men from athletes foot in the change house. Dispensed as a spray through a simple treadle, one gallon of solution provides for 3,100 treatments. Waverly Petroleum Products Co. (13)

Memos from the Manufacturers

• **The Norwegian-designed 475-ton ore crusher,** built by Nordberg Mfg. Co. in the United States, is on its way to Norway, to be installed at the Sydvaranger iron ore mines. Reconstruction of these mines at Kirkenes, destroyed during the war, is in its final phase. They formerly produced one million tons of iron ore annually.

• **Annual steel producing capacity at the Geneva, Utah,** plant of Geneva Steel Co. will be increased from 1,400,000 to 1,560,000 net tons after completion of a construction program recently announced by Walter Mathesius, president of the U. S. Steel subsidiary. Additional facilities will enable Geneva better to meet the needs for national defense and essential civilian purposes.

• **New million-dollar electronics plant** at Auburn is to be ready for occupancy by fall, according to General Electric officials, who recently gave the "go ahead" on construction. Originally planned to build television receiver parts, the plant's production may possibly be used for military purposes.

Borg-Warner Corp.: Paul J. Larsen, former director of Office of Civil Defense, NSRB, appointed assistant to president, Roy C. Ingersoll.

The Timken Roller Bearing Co.: Dwight A. Bessmer appointed assistant to the president; Paul E. Young to succeed Mr. Bessmer as director of purchases; R. J. Archibald named assistant general purchasing agent.

Industrial Brownhoist Corp.: Walter A. McLean has assumed position of manager of erection, replacing the late John J. Schreck.

Oliver United Filters, Inc.: Edwin Letts Oliver, Jr., elected vice president and member of executive committee.

Worthington Pump & Machinery Corp.: Wilbur R. Leopold appointed assistant to Vice President T. Cruthers; Clarence S. Wentworth fills post of manager of Detroit office; Wintroath Pumps Inc. of Alhambra, Calif., acquired by Worthington to operate as wholly owned subsidiary of the company, under the present management of Boyd Kern, president.

E. I. duPont de Nemours & Co.: George H. Loving appointed director of sales of explosives department, succeeding Charles B. McCoy, who was transferred to electrochemicals department as assistant general manager.

Cummins Engine Co., Inc.: Charles J. Wilhite promoted to acting Northwest regional manager, with headquarters in Seattle.

General Dry Batteries, Inc.: Carl Brooks named general sales manager, with headquarters in Cleveland.

Reliance Electric & Engineering Co.: C. Carlisle Tippit appointed general purchasing agent.

Hose Accessories Co. of Philadelphia: Arthur W. Gadd, of Kansas City, Mo., named manufacturers' representative for Missouri, Kansas, Southern Illinois, Western Iowa and Nebraska; Almon O. Snyder, of Cleveland, appointed factory representative for the territories of Ohio, Pennsylvania, West Virginia, Kentucky and southern Indiana.

Four Wheel Drive Auto Co.: William Hanson named manager of newly created market development and research department.

Raybestos-Manhattan, Inc.; New appointments for Manhattan Rubber Div. include R. J. Gorecki, factory manager; W. E. Perkins, assistant factory manager; D. J. Fenelon, director of labor relations; R. Griffith, personnel manager; J. Freeland, manager cord belt dept., and A. P. Schneider, supt. cord belt dept.

A. P. Green Fire Brick Co.: William S. Lowe, executive vice president, elected president, succeeding Robert S. Green, who recently resigned.

Allis-Chalmers: L. W. Davis recently appointed manager of Oakland, Calif., office.

Joseph T. Ryerson & Son: Charles L. Hardy elected president to succeed Everett D. Graff, now chairman of the executive committee; Thomas Z. Hayward elected vice president in charge of sales.

Sika Chemical Corp.: Announces opening of Pittsburgh branch office at 335 Fifth Ave. with Robert E. Parlette, district sales engineer.

(*Continued on page* 151)

For Maximum
ECONOMY
SAFETY
DURABILITY

CONNELLSVILLE
Bottom-Discharge
SKIPS

Connellsville Bottom Discharge Skips speed up the hoisting process, requiring less travel for dumping, and aid in accelerating the unbalanced loaded skip. Toggle-locked chute prevents skip from discharging its contents while in transit—no spillage.

Available in 1 to 25 ton capacities, the sturdily-constructed Connellsville Skip gives unequalled service under severe mining conditions.

Each skip is designed to suit your particular mining conditions . . . operation is automatic . . . construction is practically maintenance-proof . . . incorporating the best patented safety devices in use today. Connellsville Skips are your assurance of long, safe, economic mining operations.

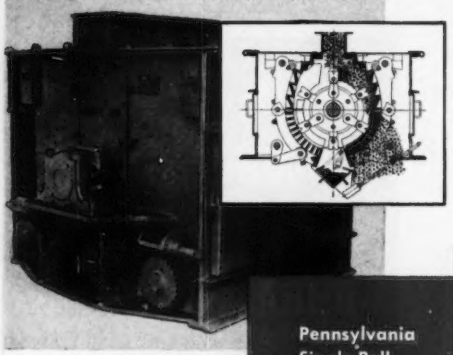
We also manufacture CAGES, HOISTS, HAULAGES, MINE FANS, ROTARY DUMPS, ROTARY ROCK DUMP CARS,—LEPLEY HOISTING EQUIPMENT, YOUGH PUMPS, and FORT PITT CAR-CAGING EQUIPMENT.

WRITE FOR COMPLETE INFORMATION

CONNELLSVILLE
MFG. & MINE SUPPLY CO.
CONNELLSVILLE, PENNSYLVANIA

SERVING THE MINING INDUSTRY SINCE 1901

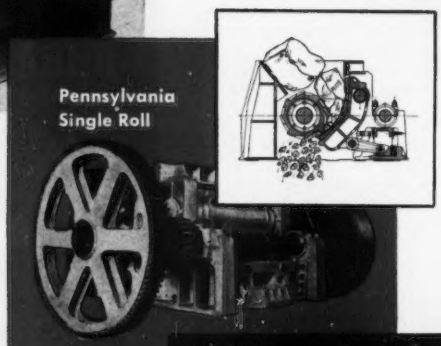
Pennsylvania Reversible Hammermill



why Pennsylvania makes many types of crushers

In the mining industries crushing problems are seldom, if ever, identical because there are variables such as product, feed size, capacity, moisture content, and physical and chemical structures of material—*and no one type of crusher can meet all of them.* That's why Pennsylvania has a large and varied line, a portion of which is illustrated here. In this line there is a type of crusher adapted to deal with each individual job no matter what it may be, and since our engineers are not limited to only one or two types when making a recommendation, you can be assured there is no bias or prejudice in favor of a specific crusher. This is one of the very good reasons to at least get Pennsylvania's counsel on every crushing job. Even if you aren't ready for a new crusher we'll be glad to check your operation and report on its efficiency. This could well be the first step towards reducing your operation costs.

Pennsylvania Single Roll



REVERSIBLE HAMMERMILL

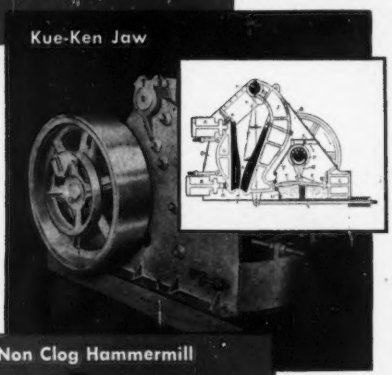
The Pennsylvania Reversible Hammermill with 2 Zone Crushing and Adjustable Cage offers great economy in operation and maintenance while producing a coarse or medium fine product without using a closed circuit system. The Reversible feature virtually makes this machine two crushers in one. Press a button—today clockwise—tomorrow, counter clockwise. Send for Bulletin 1034.

SINGLE ROLL

Requiring surprisingly little headroom, Pennsylvania Single Roll Crushers are powerful machines that have big hourly capacities at low cost per ton and can handle wet, sticky and frozen materials without choking or jamming. Massive Breaker Plate is easily adjustable to or from the Crushing Roll. This permits product size change at any time and also compensates for gradual wear of working parts. Send for Bulletin 2011.

What type of crusher do YOU use?

Kue-Ken Jaw



KUE-KEN JAW CRUSHER

The improved design of the Kue-Ken Jaw Crusher, using the "crushing without rubbing" principle, is the one great advancement in jaw crushers in many years. It replaces the old, poorly lubricated, slow speed, unavoidably heavy machine that gave operators a low opinion of the jaw. The Kue-Ken gives you — 2 to 5 times greater capacity, 5 to 10 times longer jaw plate life, much lower power requirement, a completely enclosed oil bath lubrication with clean, constantly filtered oil, and other features that put the Kue-Ken way out in front. Send for Bulletin 5011.

Dixie Non Clog Hammermill

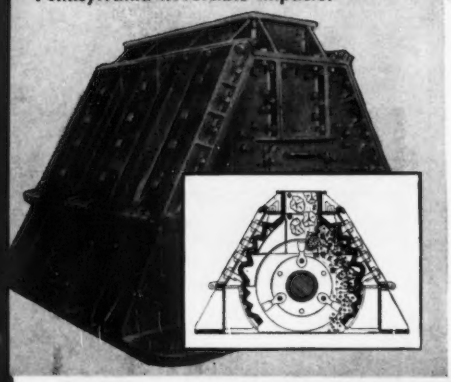
DIXIE NON-CLOG HAMMERMILL

Wherever sticky, wet materials may be encountered, there the Dixie Non-Clog Hammermill is without parallel in efficiency. The moving, extended Breaker Plate keeps the most difficult mucky feeds from choking the mill and moving right along, holding production at peak capacity. The crushing is done *on* the numerous moving Breaker Plates, therefore wear is distributed over a large area, prolonging plate life, thus reducing maintenance cost.

REVERSIBLE IMPACTOR

The Pennsylvania Reversible Impactor reduces by direct impact at controlled slow speeds, producing cubed particles uniform in size. Reduction ratio is quite large, a reduction of minus 10" feed to ¼" in one operation is not unusual. This is an ideal crusher for high silicas and abrasive rocks, clinkers, minerals and chemicals. The Reversible Rotation feature doubles the life of principal working parts. Send for Bulletin 6016.

Pennsylvania Reversible Impactor



PENNSYLVANIA CRUSHER COMPANY • *Division of Bath Iron Works Corporation* • **1712 Liberty Trust Bldg., Philadelphia 7, Pa.**

NEW YORK • BOSTON • PITTSBURGH • BIRMINGHAM • ROANOKE • DETROIT • CHICAGO • ST. LOUIS • CROSBY, MINN. • LOS ANGELES • LONDON, ENGLAND

Single Roll Crushers • Reversible Impactors • Reversible Hammermills • Ring-Type Granulators • Bradmills • Bradford Hammermills • Kue-Ken Jaws • Kue-Ken Gyracones • Dixie Non-Clog Hammermills • Dixie Feed Mills

PENNSYLVANIA CRUSHER COMPANY

PENNSYLVANIA CRUSHERS

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

CRUSHING AND SCREENING. "Facts and Figures" is a pocket-size, 62-page booklet loaded with tables and information on crushing, screening, washing, materials handling and aggregates, just published in the 10th edition by Pioneer Engineering Works, Minneapolis, Minn. (71)

ORE TEST. "How to Schedule an Ore Test" (Bulletin T4-B10) is a 4-page folder telling you how to go about preparing an ore sample for testing at Denver Equipment Co. laboratories, where to send it, and how the information can help you. (72)

SHOVEL DIPPERS. Here's a 40-page booklet, No. 547DS, packed with information on Amsco dippers and parts for shovels and draglines, issued by American Manganese Steel Div. (American Brake Shoe Co.) Chicago, Ill. (73)

STEEL SHEETING. How to use lightweight corrugated steel sheeting to effectively control movement of soil or water, is described in this illustrated, 10-page booklet, "Armco Steel Sheeting for Trenches, Cofferdams, Cut-off Walls, Shore Protection" by Armco Drainage and Metal Products Inc., Middletown, Ohio. (74)

BUILDING MAINTENANCE. "Maintenance Checking Chart" published by United Laboratories, Inc., Cleveland, Ohio, lists many common building maintenance problems and recommends a solution for each. The chart lists over 100 products and processes for taking care of floors, roofs, interior and exterior walls, waterproofing, special paints, etc. (75)

DRILLING EQUIPMENT. In capsule form, Bulletin 33 gives you a look at the complete line of equipment manufactured by Acker Drill Co., Inc., Scranton, Pa. (76)

GRAVIMETRIC FEEDER. Full details with pictures and drawings, on the Midget Belt Gravimetric Feeder, a small weighing feeder for dry chemicals, are contained in the 8-page bulletin (35-G5) offered by Omega Machine Co., Providence, R. I. (77)

HARD SURFACING. A 4-page bulletin, "Hard Surfacing Manganese Steel" outlines applications, precautions and suggestions on proper procedures. Rankin Mfg. Co., Los Angeles, Calif., puts out this bulletin. (78)

CHAINS AND SPROCKETS. Jeffrey Mfg. Co., Columbus, Ohio, announces a new catalog, No. A418, covering its complete line of chains and sprockets for both new and replacement service on elevating and conveying equipment, and for drives. (79)

CONVEYOR BELTS. Featured by illustrations which portray in detail all major parts used in construction of its line of conveyor and elevator belts, B. F. Goodrich Co., Akron, Ohio, has just issued a 26-page catalog section on the subject. (80)

VISE. New and different, the Slide-Set vise can save you time and energy in the machine shop. Bulletin A-601 offered by Dodge Mfg. Corp., Mishawaka, Ind., tells you all about this unique tool. (81)

AUTOMATIC VALVES. A cross-section of Cash-Acme's entire line of automatic valves is described in Bulletin No. 229 issued by A. W. Cash Valve Mfg. Corp., Decatur, Ill. (82)

CONVEYOR BELTING. What kind of a job do you have for conveyor or elevator belting? Thermoid Co., Trenton, N. J., stands ready to help you select the right belting. At least their 16-page Bulletin No. 3679 is complete with all necessary tables, charts and formulas for selecting the right type of belt with a discussion of each. (83)

CRUSHER PARTS. Saving wear and tear on your crushing and pulverizing equipment with Tisco manganese steel parts, is the subject of the discourse in Bulletin 350 put out by Taylor-Wharton Iron & Steel Co. (84)

FILTER. Denver Equipment Co., Denver, Colo., use Bulletin F9-B2 to give you all the vital information on their disc filter, including operation, specifications, capacities, dimensions and advantages. (85)

STAINLESS STEEL. What Carpenter Stainless No. 20 can do for you and how it has proved its corrosion resistance, specific reaction to a number of solutions and physical properties, are all covered in this 18-page booklet issued by Carpenter Steel Co., Reading, Pa. (86)

THERMOMETRY. A new 56-page edition of its thermocouple and pyrometer accessories bulletin is available from Bristol Co., Waterbury, Conn. Technical information and installation sketches have been added with engineering data on modern practices in pyrometry. (87)

METAL TESTING. Non-destructive testing of metal parts and welds is easily done by applying Dy-Chek with brush, spray or dip methods. This simple check can be made in factory or field and save you many headaches. Bulletin 500, a 4-page folder, issued by Dy-Chek Co., Hawthorne, Calif., tells you all about it. (90)

COMPRESSOR. "First compressor to have anti-friction roller bearings throughout," is the claim made by Chicago Pneumatic Tool Co., New York, for its Class O-CE horizontal duplex motor-driven compressors. Bulletin 726-5 tells you all about the unit. (91)

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7	14	21	37	44	51	77	84	91

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Equipment Shorts

SPRAY GUN PUMP. If spray guns spurt while spraying heavy industrial materials, it causes unevenly coated surfaces. This air-operated, high-volume Mogul-Type Powerflo pump uses a device called an Evenflo which prevents spray gun spurting. Gray Co., Minneapolis, Minn., the manufacturer, states that the Mogul will save you time and money in coating surfaces. (31)

HOISTS. A new line of heavy-duty electric cable hoists, manufactured in sizes from ½ to 5-ton capacity, has been announced by Cleveland Chain & Mfg. Co., Cleveland. New hoists will be trade-named "Bob-Cats." (32)

HUMIDITY CONTROLLER. Plug-in humidity controller eliminates complicated electrical installation. All you do is plug the humidifier or dehumidifier into the control; plug the control into the wall outlet; set the dial at the percentage of relative humidity desired and you're all set. Abbeon Supply Co., Woodside, New York, is the maker. (33)

SYNCHRONOUS GENERATORS. General Electric Co. has extended its line of Tri-Clad high-speed synchronous generators down through 1,875 kva. This gives the line a range from 1,875 to 1,250 kva. (34)

INDUCTION MOTORS. Fairbanks, Morse & Co., Chicago, recently extended their line of type QZE, totally enclosed, non-ventilated, squirrel-cage, induction motors to include continuous duty ratings built in NEMA standard frame 284. Presently in production are 7½-hp., 1,800 rpm and 5-hp., 1,200 rpm. motors. (35)

PLEXIGLAS. To provide full visibility upward as well as to front and sides while shielding the operator from sun glare, new models of the diesel-electric cranes made by American Hoist and Derrick Co., St. Paul, Minn., are equipped with a dome section of green Plexiglas ¼ in. thick in the front quarter of the cab. Plexiglas is a product of Rohm & Haas Co., Philadelphia. Plastics, Inc., forms the sections. (36)

DIESEL ENGINE. This 2-cylinder, 4½x5¼-in. diesel engine is a complete self-contained, ready-to-operate unit for stationary and portable uses. Known as the 4FS2 the 4-cycle diesel is rated from 20 to 30 hp. within an operating speed range of 1,200 to 1,800 rpm. Nordberg Mfg. Co., Milwaukee, Wis. (37)

PORTABLE COMPRESSOR. The latest edition to the Schramm, Inc. (West Chester, Pa.) line of portable compressors is Model 600, equipped with a 6-cylinder diesel engine and capable of delivering 600 cfm. (38)

AUTOMATIC TITRATOR. This easy-to-operate automatic titrator handles routine titrations automatically, releasing your laboratory technician for other tasks and eliminating the source of personal error in titration. Accommodates beakers from 10 to 400 ml. capacity and all standard burettes down to 5 mL in size. Beckman Instruments, South Pasadena, Cal. (39)

JOINT COMPOUND. Cyl-seal is applied in liquid form to flanged or threaded pipe connections and changes in the joint to a tough elastic solid with good resistance to vibration and corrosion. It molds a gasket in every joint. West Chester Chemical Co., West Chester, Pa. (40)

PROTECTIVE COATING. Aluminum coating (B-99) for metal, masonry or wood is ready-mixed, unaffected by acids, alkalies, oils, water and corrosive fumes. It needs no special primers, is non-toxic, can be applied over most old paints, retards fungus growth, is waterproof and dries fast. A single gallon costs $5.95; a 5-gal. container costs $5.80 per gallon. David E. Long Corp., New York, N. Y. (41)

LIFTING MAGNET. For loading, transporting or otherwise handling all types of magnetic materials, the lifting magnet can be installed on overhead or crawler cranes. Improvements include lighter weight, welded construction, balanced magnetic circuit, 4-point suspension. Dings Magnetic Separator Co., Milwaukee, Wis. (42)

CRUSHERS. The 1951 line of Bulldog moving breaker plate hammermills for crushing sticky or high moisture materials has been announced by Hammermills, Inc., division of Pettibone Mulliken Corp., Chicago, Ill. Accessibility of easily adjusted controls to produce variable size product, and heavier shafts with anti-friction bearings are new features. (43)

FLEXIBLE STEEL HOSE. Developed for use where extreme temperatures and corrosion are factors, this new stainless steel corrugated flexible metal hose is fabricated from thin wall tubing. Sizes range from ¼ through 4 in. I.D. and wall thicknesses from .010 to .035. Allied Metal Hose Co., Long Island City, N. Y. (44)

CORROSION SERVICE. Corrosion-proof materials and advisory service in selecting the proper material for a specific corrosion problem, either plastics or alloyed metals, are offered by National Molded Piping Distributors, Jersey City, N. J. Staff engineers are available for free advice on special materials to meet your problems. (45)

DIESEL ENGINES. New line of heavy duty diesel engines has been announced by Murphy Diesel Co., Milwaukee, Wis. Six models from 145 to 220 hp. are designed to operate at continuous speeds up to 1,400 rpm. (46)

HEAT RESISTANT PAINT. Aluminum paint, capable of withstanding temperatures up to 1,700° F. uses a silicone base. Known as Heat-Rem H-170, it fuses with surface metal upon application, according to the manufacturer, Speco, Inc., Cleveland, Ohio. (47)

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NEW PRODUCTS DIGEST

John A. Roebling's Sons Co.: Howard E. Maloney new manager of sales, electrical wire division; Frank T. Craven appointed assistant manager of sales; Roy H. Hainsworth named Eastern regional manager, with headquarters in Trenton, N. J.

Atlas Powder Co.: New assistant to the president is Ralph K. Gottshall, assistant general manager of the explosives department; D. J. C. Copps appointed assistant general manager to succeed Mr. Gottshall.

General Electric Co.: Robert J. Baumanne named marketing research section manager of Chemical Dept.; Ab Martin appointed manager of Fort Wayne (Ind.) works of Apparatus Dept.; C. H. Matson new manufacturing consultant of Small Apparatus Division Staff.

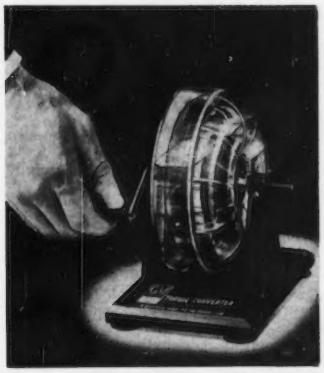
Westinghouse Electric Corp.: C. Spence Purnell appointed eastern district manager of the newly-formed Agency and Construction Divisions.

Roots-Connersville Blower Corp.: Names Koerner Engineering & Supply Co. of Portland, Ore., as exclusive sales agents for all R-C products in the states of Oregon and Washington.

Koehring Company of Milwaukee: Recently appointed distributor in Washington and Idaho is the American Machine Co., Spokane.

The Electric Storage Battery Co.: ESB International Corp. formed to carry on the foreign business of the company and its subsidiaries.

Goodman Manufacturing Co.: Morris F. Cunningham elected vice president in charge of sales succeeding the late A. C. Green; William T. Ferguson appointed sales manager; Cedric E. McWhorter named mining engineer.



TORQUE CONVERTER MODEL shows how General Motors Series 71 unit works. Available for inspection at GM (Detroit Diesel) distributors and dealers. In a few seconds this model shows how the converter changes to and from a fluid coupling drive automatically.

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Even on the toughest piping jobs VICTAULIC Couplings, Victaulic Full-Flow Elbows, Tees and other Fittings will make joining those pipe ends quick, easy and economical – assure you a leak-tight piping job!

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GALIGHER METALLURGISTS have successfully completed tests on ferrous, non-ferrous minerals, coal and many other substances. Results of these findings are reflected in hundreds of successful installations . . . proof that Galigher tests can be duplicated and confirmed in full-scale operations.

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U. S. A. MEXICO SOUTH AMERICA

Georgia *(Continued)*

Thompson, Weinman & Co.'s plant at Cartersville. The operation, locally, has two divisions: (1) Grinding pure white marble, mined at the company's property at Gantts Quarry, near Sylacauga, Ala., and (2) washing and grinding barite, or barytes, mined locally by its subsidiary Paga Mining Co. G. W. Beavers is in charge. A. O. Franz is superintendent of the Paga company.

IDAHO

★**Dividend returns of mines in the Coeur d'Alene district** for 1950 have now all been officially filed with the Shoshone County assessor. Fourteen mining companies have paid dividends for 1950 in the amount of $6,846,039, as compared to $5,793,212 in 1949, making a grand total dividend disbursement for the district during the past 64 years of approximately $216,401,681.

★**Silver Dollar Mining Co.** is now drifting westerly in the footwall area of the wide mineralized zone recently cut by a crosscut on the 1,800-ft. level in ground covered by the Purim claim, which is owned by the Haydend Hill Mining Co., but is under a long-term lease to Silver Dollar and Silver Summit Mining companies.

★**Operations at the old Hercules mine** of the Day Mines Co. at Burke were temporarily interrupted this month by the burning out of the 600-hp. electric motor supplying power for hoisting operations. The motor was first operated from 1915 to 1925, when the mine was closed down and was idle until 1948 when mining operations were resumed.

★Triumph Mining Co., in the Warm Springs district of Blaine County, whose milling plant recently burned down, has nearly completed a **new 200-ton plant** embodying the latest developments in ore separation.

★State Mine Inspector George McDowell reports **nine fatal accidents** in Idaho for 1950 as against eight last year.

★**High-grade phosphate rock** development near Soda Springs, has resulted in exposure of an estimated 25,000,000 tons, according to Charles Baker, of Walla Walla, general manager of Pacific Supply Co-operative Corp. Plans to mine the deposit depend on an adequate power supply.

★Coeur d'Alene Mines Corp. is now operating its mill on **1,000 tons of stockpiled silver ore** from the prospect raise on the ore shoot discovered last fall. This is the second mill run from the same shoot. The raise is in extralateral rights area of the American Silver property and is being extended in the hope that the ore shoot will be longer than the

50-ft. found on the 2,800-ft. level, where it was cut off by a fault.

★**Day Mines, Inc.**, recently offered the Coeur d'Alene Mines Corp. a plan by which Day Mines would develop the Rainbow group on a 50-50 production basis, offering to spend $600,000 in a deep development program.

★**Nabob Mining Co.**, on ground adjoining the Sidney mine, is developing a large and promising body of lead-zinc ore in what is known as the Crystolite vein system in a new ore zone crossed in the Nabob deep tunnel development.

★Vindicator Silver-Lead Mining Co., owner of a group of claims adjoining Lucky Friday on the east, is **looking for capital** to sink a 600-ft. shaft on an ore showing similar to Lucky Friday. On the 400-ft. level Vindicator has a shear zone vein 40 ft. wide that shows a continuous streak of galena ore which has been proven for 500 ft. in length.

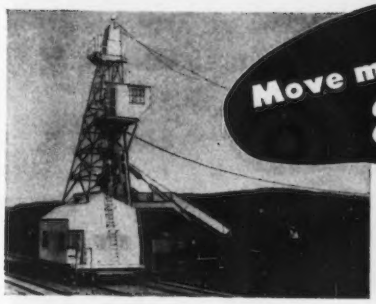
★**An electrostatic and magnetic separation plant** to recover values from rare sands being dredged from a central Idaho placer property is under construction at Boise.

Associated in the enterprise are J. R. Simplot, Idaho industrialist, and Fred Baumhoff, of Baumhoff-Marshall Co., which has operated gold dredges in the Boise Basin mining district for many years. The plant, which was expected to be ready for operation before the end of the year, will separate monazite, ilmenite, zircons and garnets, Baumhoff said. A small quantity of gold also may be saved.

IRON COUNTRY

★All the mining companies of the Lake Superior area have announced **new wage schedules** following the increases granted by the various steel companies. The contract of the Oliver Iron Mining Co. with the CIO union which affects 6,600 men in their Minnesota and Michigan mines, provides for a 12½c. general wage increase as of Dec. 1. In addition a joint study with the union will be made of wage rates for the various job classifications. It is expected that wage rates for some of the classifications will be increased.

★On Dec. 14 **Oglebay, Norton & Co.** leased space in the Christie building, 120 North Fourth Ave., West, Duluth, as headquarters for its Lake Superior area taconite and mining operations. Frank J. Smith, vice-president, Montreal, Wis., said the company's northern office at Montreal will be moved to Duluth in early 1951. H. S. Taylor, president, said that Oglebay, Norton & Co., as operating agents for the Reserve Mining Co. of Cleveland, will build a $6-million taconite pilot plant near Biwabik in 1951, preliminary to full scale beneficiation



Sauerman Tower Machine equipped with 6 cu. yd. Crescent scraper, handles large stockpile at rate of 250 t.p.h. Machine stocks out the material as discharged on dock from cargo ships and then reclaims to cars.

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It reaches far . . . digs powerfully . . . hauls rapidly

There's one sure way to cut costs on long range material handling — use a machine that does the whole job without help — a machine that digs, hauls and dumps in one continuous cycle.

Sauerman excavators are of two main types —power drag scrapers and slackline cableways. Either of these two machines will span a large area and move material at a rapid rate from point to point anywhere within that area, under finger-tip control of one operator.

Of the two machines, the Sauerman power drag scraper has the wider application as a general purpose excavator and stockpiler. The slackline cableway finds its greatest usefulness when the job calls for digging deep, particularly under water, and lifting to a high delivery point.

Both machines are alike in their simplicity, ease of operation, moderate power requirements, low maintenance expense and their ability to work on any kind of ground. Every Sauerman machine is carefully engineered and constructed to give long, trouble-free service and to stand up under tough digging and heavy loads. Many Sauerman machines in operation today have been running for more than a quarter of a century and still are considered just about as good as new by their owners.

Write today for our catalog. If you have a material handling problem that is bothering you, tell us about it and our engineers will give you their ideas as to the equipment and methods best suited to your requirements. There is no cost or obligation for this service.

HILLSIDE EXCAVATION

The picture shows how a Sauerman scraper digs into a hill of hard-packed glacial gravel and moves the gravel to a crushing and screening plant.

STOCKPILING SIMPLIFIED

Small Sauerman scraper handles seasonal storage of 30,000 tons of surplus output annually at crushing plant, piling the surplus material in a single long pile and later reclaiming to a car-loading hopper.

DIGGING UNDER WATER

Here is a Sauerman slackline cableway moving gravel out of a deep pit 400' wide by 900' long which it dug during the last two seasons while producing about 300,000 cu. yd. a season.

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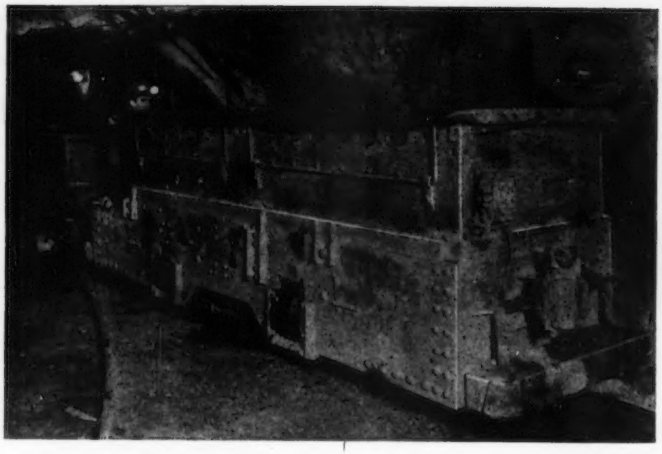

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Because they're the best mine haulage batteries that can be made, EDISON batteries cost a little more initially. But they pay this back over and over in terms of tons hauled, years worked and down-time saved.

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STORAGE BATTERIES

Iron Country *(Continued)*

later at Beaver Bay. Mr. Smith said the Babbitt pilot plant will be constructed with equipment of identical size as one of eight sections that will eventually comprise the initial Beaver Bay project of about 2½ million tons annual production. Eventual cost is expected to be about $160 million.

★On Dec. 14 the **Oliver Iron Mining Co.** honored 165 veteran employees who, together, represented more than 5,000 years of service with U. S. Steel subsidiary companies. A banquet was held and service awards were given out by John H. Hearding, Jr., general superintendent in the Hibbing-Chisholm district. Eight employees received 45-year service emblems; 27, 40-year and others were awarded 35, 30 and 25-year emblems.

★New officers of the **Engineers' Club of Northern Minnesota** are: W. P. Wolff, Hibbing, chief engineer for the Oliver Iron Mining Co., president; T. C. Thielman, Elcor, Pickands, Mather & Co., superintendent at Embarrass, vice-president, and Hugh J. Leach, Marble, superintendent at Cleveland Cliffs Iron Company's Hill-Trumbull mine, secretary-treasurer. Eastern district directors are Lloyd S. Campbell, Virginia, and George C. Watts, Aurora, Central district, C. R. Burton, Hibbing, and C. E. McManus, Hibbing; Western district, David H. Hill, Coleraine, and D. R. Wilson, Marble. James R. Stuart, Hibbing, is the retiring president.

★Inland Steel Company's new steamer, the Wilfred Sykes, established a **remarkable record** in her first season of operating. The 678 ft. long "Queen of the Lakes" carried 660,011 tons of ore during the season: 1.7 times the volume carried by the average freighter. Her average cargo was 18,334 gross tons as compared to 10,412 for the 260 ore boats in the trade last year. The big boat made 33 trips to Superior and her best time was four days and 23 hours including loading and unloading time. Three trips were made to the Marquette docks. The Sykes traveled at 18.2 mph. light and 16.2 mph loaded.

★A fire at the Section 18 mines of the **M. A. Hanna Co.** on Dec. 22 destroyed the mine shop and garage. Two Euclid trucks, a large number of new truck tires, valuable shop equipment and employees' tools were lost. The cause of the fire has not been determined and the loss may exceed $100,000.

★The Nashwauk council has granted a franchise to the Iron Range Natural Gas Co. to **pipe gas into Nashwauk for public and private use.** Construction has been started on a gas pipe line between the Twin Cities and Duluth.

★The **1950 tax valuation** of Itasca

County, which includes the western Mesabi range, has been increased from $17,179,007 to $20,137,832. Assessor Hugh Logan says that much of the increase is due to higher ore valuations.

★**Pacific Isle Mining Co.** shipments for 1950 were 354,878 tons of which the Lamberton furnished 160,066 tons and the York 132,772 tons. The balance of 57,664 tons came from various lean ore dumps at other "exhausted" mines.

★Oliver Iron Mining Co. concluded its **all-rail ore shipments**, begun in July, during the last week of November when cold weather made the frozen ore difficult to unload at its eastern furnaces. Shipments totaled almost 1½ million tons and were undertaken because of the late opening of navigation on the Great Lakes.

★On Dec. 27, **135 cars of ore** treated with calcium chloride to prevent or lessen freezing, were loaded at the Monroe pit for shipment to eastern steel mills. R. T. Elstad, Oliver Iron Mining Co. president, said the shipment was an experimental one to test the car steaming and thawing equipment recently installed at U. S. Steel mills in Chicago, Pittsburgh and Youngstown areas. If the tests are successful it is possible that all-rail ore shipments may be continued through the winter and may total 400 cars per day.

"We hope to move enough ore by rail this winter to help make up the difference and keep our steel industry producing at its full rate of capacity," Mr. Elstad said.

★U. S. Steel's South Chicago plant has begun thawing an experimental shipment of 50 carloads of frozen Mesabi ore. The corporation plans to ship 2 million tons this winter to the plants mentioned above and expects to receive 500,000 tons in the Chicago district. At Gary the thawing is being done inside the company's gates. Four old leased locomotives provide the steam to warm the tightly frozen ore. The thawing process consists of piercing a load of ore with a steel jet and applying steam. About eight hours is required. Previously the ore has been treated at the mines with calcium chloride.

★M. A. Hanna Co. is developing a **new open-pit mine on the Cuyuna range** called the Section 6. Stripping was begun in November and plans call for the removal of about 1½ million cu. yd. during the winter in order to have the property ready for ore production in 1951. Stripping will be handled by a 7 W dragline and 54-B diesel shovels with 24-yd. bottom-dump semi-trailers and 20-ton end-dump trucks. Ore will be hauled by trucks to the Maroco plant for beneficiation.

★Stripping will be continued at the **Morton mine** during the winter with standard shovels and trucks. A total

This EXTRA 75% is Provided Only by *SuperDuty*

The *DIAGONAL DECK* design of the *SuperDuty* Concentrating Table places 75% more working riffles in the natural path of the material flow across the table. This is possible in no other deck design.

These extra working riffles add phenomenal efficiency to the work of the *SuperDuty* by fanning out the material bed for more accurate cutting. The result is higher grade concentrates, cleaner tailings and reduced middling load for recirculation. This in turn adds to capacity by making room for more tons of new feed per day. For full information ask for Bulletin 118A.

FOR SCREENING ECONOMY

The Leahy Vibrating Screen possesses an uncanny ability to do a job right—and in record time. It screens wet or dry, using screen cloth or perforated plate. Excellent for fine mesh screening, dewatering or desanding. Range from 2" to finest mesh. Ask for Bulletin 14H.

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RC 129

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Iron Country *(Continued)*

of about 4½ million cu. yd. had been removed by Jan. 1, 1951. A 6½-cu. yd. shovel has arrived at the mine and is being set up. Two new 35-ton trucks are in service.

★The Hanna Co. estimates that about **14½ million cu. yd. of overburden will be removed** before the 1951 ore season begins. Mines that will be active in stripping work this winter include: the Morton; South Agnew; Perry; Buckeye; Argonne; Section 18; Mississippi group; Galbraith; Harrison; Cuyuna group; Douglas; Weggum and Spring Valley. A considerable amount of construction work is also planned.

★The report of the **Minnesota Department of Taxation** to the governor and legislature showed that Itasca County iron ore reserves decreased only slightly during the last 25 years, from 154,389,000 tons in 1924 to 150,492,000 tons in 1949. The Mesabi range of St. Louis County suffered a heavier loss during the same period, dropping from 1,111,622,000 tons in 1924 to 750,467,000 tons in 1949. The depletion of high-grade ore is reflected in the assessed valuation per ton. The report shows total remaining tonnage in Minnesota at 951,011,699 tons valued at $125,777,567. Total shipments from Minnesota from 1881 through 1949 are shown in 1,809,024,110 tons.

★**Oliver Iron Mining Co.** shipped about 35,400,000 tons of iron ore from its mines in the Lake Superior area during the 1950 season, or 45.265% of the total Lake Superior vessel shipments which amounted to 78,205,681 tons.

★Inland Steel Co.'s **Sherwood mine** at Mineral Hills with 100 men and and Bristol mine at Crystal Falls with 80 men, both on the Menominee Range, went on a six-day week in early December in place of the five days that had been in effect for some months.

★A. Lindberg & Sons of Ishpeming have been awarded a contract by the C. & NW. Ry. Co., Duluth, South Shore & Atlantic Ry. Co. and the Lake Superior & Ishpeming Ry. Co. for the **construction of new rail lines into Negaunee** from the east. The work will require the moving of 50,000 cu. yd. of rock, 500,000 cu. yd. of dirt and two bridges of steel and concrete. It is necessary for the roads to re-route their tracks into Negaunee to permit the Jones & Laughlin Ore Co. to proceed with its program for its new Tracy mine in the southeastern part of Negaunee. A. Lindberg & Sons also have a contract for sinking the Tracy shaft a distance of 108 ft. and have started this job.

★The Vicar mine of the Jones & Laughlin Ore Co. at Wakefield has suspended operations and much of its equipment will be transferred to the

new Tracy mine at Negaunee. The Vicar shipped 97,124 tons in 1950. Part of the mine crew will remain for a time at Wakefield to handle the transfer of the equipment.

★The Bradley mine of the **Jackson Iron & Steel Co.** at Iron Mountain, shipped 32,618 tons of ore during the 1950 season as compared with 14,000 tons in 1949.

★**M. A. Hanna Co.'s Michigan mines** will continue to mine ore for stockpiling during the winter, anticipating an active demand in 1951. The Wauseca mine is constructing a large, modern dry-house and the dry-house at Hiawatha No. 1 has been dismantled and is being rebuilt at Hiawatha No. 2 shaft. Dewatering is under way at the Tulley mine and the Homer is developing the 10th level from two winzes.

★North Range Mining Co.'s **Champion mine** is shipping ore all-rail to the Pittsburgh and South Chicago areas. It may continue all through the winter.

★Jones & Laughlin Steel Corp.'s president, Ben Moreell, has announced that the corporation is **adding equipment to its Benson mines** plant at Star Lake, N. Y., to handle non-magnetic ore, a large tonnage of which exists in the orebody. The project will be completed in 1952 and will add 30% to the mine's output. About 17% of the corporation's ore requirements comes from Benson Mines. At present only the magnetic ore is being handled in the plant.

MICHIGAN

★**Calumet & Hecla Consolidated Copper Co.** is being licensed to use the Gardner hydraulic hoisting system (E&MJ, Sept., 1950, p. 84) in its operations and to sub-lease its use to other mining companies, according to Percy S. Gardner, Jr., who developed the system. Mr. Gardner has been retained by Calumet & Hecla to further develop his process.

The system, a method of hoisting material in a hydraulic pipe column in vertical shaft mining operations, is considered particularly effective where the amount of water underground requires continuous pumping. It operates on the theory that water flowing upward through a pipe under pressure will carry material with it. Therefore, if the ore underground is introduced into the pipe used for transporting mine water to surface, the ore will be carried to surface by the water pressure.

★**Quincy Milling Co.**, through its smelter division, has furnished a consignment of lump slag to Milwaukee interests for experimental material to be used in the manufacture of mineral wool. The slag is the product of an old cupola now out of commission. It is estimated that there are

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The Hardinge Conical Ball (or Pebble) Mill is unequalled in efficiency. Natural size segregation of grinding media, from feed to discharge. Bulletin 17-B-1 for dry grinding; Bulletin AH-389-1 for wet grinding.

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"Auto-Raise" driving mechanism lifts scrapers above all obstructions and overloads—eliminates breakage. Spiral scraper cleans tank bottom in one revolution. Bulletin 31-D-1.

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Measure by weight, not volume. Eliminate variations due to change in specific gravity, bin segregation or size of material. Bulletin 33-D-1.

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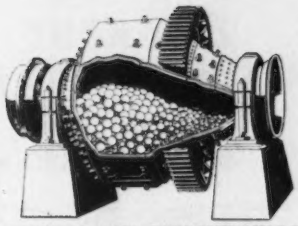
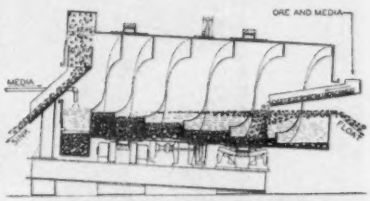
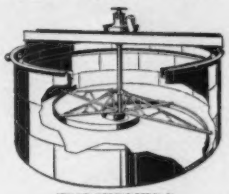
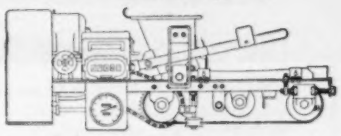

CONICAL AND TRICONE MILLS



HEAVY-MEDIA SEPARATORS
COUNTER-CURRENT CLASSIFIERS


THICKENERS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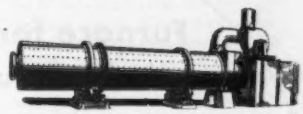
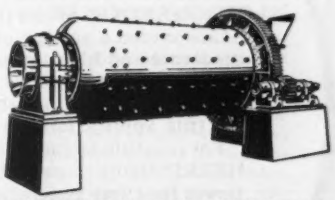

RUGGLES-COLES DRYERS, KILNS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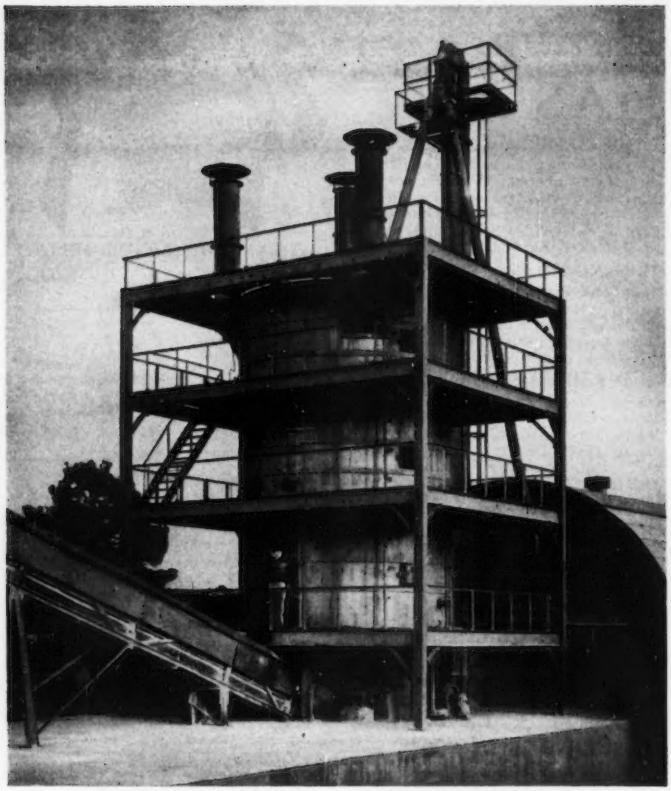

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Michigan *(Continued)*

more than 25,000 tons available. Two carloads of lump slag have been shipped to Milwaukee as a result of experiments. If the operations prove satisfactory, it is likely that much or all of the deposit will eventually be shipped.

MONTANA

★**Last Chance Gulch Mining Association,** Helena chapter of the Mining Association of Montana, on Dec. 9 held a special dinner and meeting to honor Arthur E. Adami, native of Helena, dean and acting president of the Montana School of Mines and acting director of the Montana Bureau of Mines and Geology.

★According to Eastern advices, **the aluminum plant** of the Harvey Machine Co., Inc., of Torrance, Calif., to be built near the Hungry Horse Dam, Montana, will have a capacity of 72,000 tons of aluminum products per year. Leo M. Harvey is president of the company which was established in California in 1913.

★Caledonia Silver-Lead Mining Co., Kellogg, Idaho, has acquired a perpetual contract for **mining and marketing a large clay deposit** in the South Moccasin mountains, near Lewistown. The clay is said to be dickite, a form of hydrated silicate of aluminum, of the same chemical composition as kaolinite, and is described in "Miscellaneous Contribution 9," published by the Montana Bureau of Mines and Geology in 1947. The clay deposit was acquired upon the recommendation of Frank Eichelberger.

NEVADA

★H. W. Gould & Co. of San Francisco has bought **the nation's largest deposit of high-grade fluorspar** at the Baxter mine, Mineral County, for $350,000. The deposit is 450 ft. deep, 3,750 ft. long, and entered through four shafts. The company plans to build a $500,000 mill capable of processing 250 tons of fluorspar daily at the mine site. The ore previously was hauled to distant points for milling.

★Eureka Corp., Ltd., which has already put **$7 million into its Nevada operation,** has asked the Defense Minerals Administration for a federal loan to push development work at its Eureka property. Zinc and lead, high on the Government's essential ore list, are among the minerals the company proposes to produce.

Since starting an exploratory drilling program Aug. 1, 1950, Eureka has drilled about 4,300 ft. of rotary drill hole from the surface and about 750 ft. of diamond drill hole from two underground locations.

★Wage increases of 25c. per hour became effective Jan. 1 for employees of the **Nevada-Massachusetts Mining Co.** at their property in Pershing County. Members of the Tungsten Miners Union accepted the offer, made by company officials, and the new contract is for one year. In addition to the wage increase, the company will provide hospitalization insurance for all employees and their families.

★**Discovery of radioactive ore** which also shows a quantity of vanadium has been announced by Dave Stonebraker, Andy Willis and E. T. Dorsett, who are operating the Mohawk property in western Esmeralda County. The mine is being put into operating condition. Ore averages an ounce of gold to the ton and lead in sufficient quantities to warrant shipments, according to the operators.

★**Getchell mine**, one of Nevada's largest producers, has announced plans to convert its operations to handle its own and custom tungsten ore on an emergency footing during the coming months. R. A. Hardy, consulting engineer for the company, said that two or three buying depots for tungsten ore and probably one for concentrates will be set up in the state. The Getchell Co. owns four tungsten properties in the Getchell mine district which can start producing concentrates within a very short time, according to Mr. Hardy.

★Little Jupiter mine in northern Pershing County is preparing to ship a carload of ore in order to get a test of the profit possibilities. Samples have indicated the ore contains 4 oz. of gold to the ton and about 12% lead.

★Using a steam plant and a 9½-cu. ft. bucketline dredge, the **Natomas Co.** is carrying out large-scale operations near the mouth of Copper Canyon. The deposits extend from the mouth of Copper Canyon into the valley below.

★Edward H. Snyder, president of **Combined Metals Reduction Co.**, announced in Salt Lake City that expansion of company facilities at Henderson, Nev., is definitely contemplated. The program includes installation of an electric furnace for making manganese alloys if sufficient power is available. The proposed furnace would be operative at the former Basic Magnesium plant as early as June 1, 1951, according to Mr. Snyder.

★Work of unwatering the main working shaft on the **Peterson antimony property** in the Will Creek mining district is now under way. A bond and option on six claims have been taken by Robert B. McPherson, of San Francisco, and a small crew is now engaged in placing the property, owned by Mr. and Mrs. Magnus Peterson, on a production basis. During the past year, a considerable tonnage of good grade antimony was produced.

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SHEFFIELD
MOLY-COP
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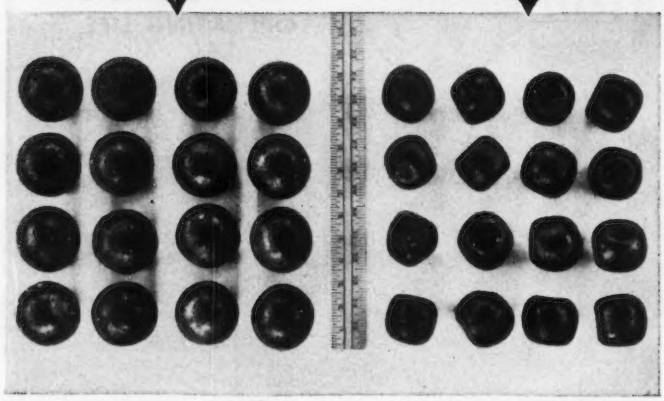
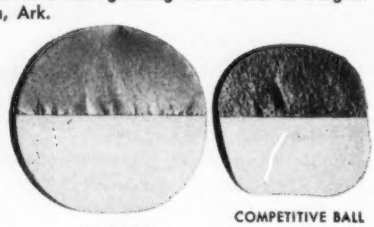
VS.
COMPETITIVE
FORGED BALLS



THERE *IS* A DIFFERENCE IN FORGED STEEL BALLS

Again, the longer wearing qualities of Sheffield Moly-Cop balls have been demonstrated. This time in a test grinding barite ore at Magnet Cove Barium Corp., Malvern, Ark.

An equal number of Moly-Cop and competitive forged steel balls were charged into the same mill at the same time and were recovered after 4604 operating hours. All were originally 3½ inch nominal diameter and marked for identification.



MOLY-COP COMPETITIVE BALL

The recovered test balls are shown in the top photograph. Clearly evident is the difference in rate of wear. The *competitive forged balls* wore 38% *faster*, based on average diameter loss. Note also the pronounced difference in retention of spherical shape.

Typical fractures of the two types of test balls are shown in the lower photograph. Note the fine, hard, martensitic grain structure of the Moly-Cop ball.

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NEW MEXICO

★**The Oroquay Milling & Mining Co.**, operating two mills at a gold mining property near Golden, is planning to erect a smelter. Ralph Sparks is owner of the lease. N. W. Ferraro is general superintendent and manager

★The town of Grants has been in a furore since announcement Dec. 11 of a **large uranium find on railroad land nearby.** The Santa Fe Railway Co. is making a thorough study of the mining possibilities on a 90-acre tract, but company geologists say that the ore is contained in at least 10,000,000 tons of carnotite-bearing rock, and runs from 1/10 to ¼ of 1% uranium oxide. The railroad will ship 10 tons of the ore to the AEC mill in Utah for analysis.

★State Mine Inspector John A. Garcia has announced that **New Mexico's 1950 production of ores** had a total value of $50,000,000 with copper leading the metals at $20,428,000, and potash leading the non-metallics with a production value of $23,787,000. Other values: zinc, $2,717,000; fluorspar, $322,000; molybdenum, $448,000; iron-manganese, $220,000; pumice, $428,000.

★**Southwest Potash Co.**, fifth to enter the Carlsbad potash district for production, will spend $10,000,000 to get started by the end of 1952 with an initial capacity of 185,000 tons, according to an announcement of the parent company, American Metals Co., Ltd., at New York.

★**U. S. Ferro Metals Corp.** has announced plans for plants in New Mexico costing about $400,000 to handle a defense contract for 50,000 tons of manganese worth $2,500,000.

★The U. S. Circuit Court of Appeals at Denver, Colo., affirmed on Dec. 30 the **contempt of court convictions** against three potash union leaders at Carlsbad, N. M. The three, C. D. Smotherman, president of the local unit of International Mine, Mill & Smelter Workers Union, William Gatly and Henry Brackhahn, were fined $500 each for blocking lines of the Santa Fe Railroad during a strike at the three potash mines which started in Nov., 1949, and lasted 73 days.

NORTH CAROLINA

Mineral industries of the area centering in Spruce Pine, western North Carolina, were shipping at a rate of over $8,000,000 per year at the end of 1950, according to S. T. Henry, of Spruce Pine. These figures cover the business being done by three producers of primary kaolin, five feldspar grinders, several producers of wet-ground mica and five plants dry-grinding mica. They also include the sales of several local mica-fabri-

cating plants which depend on imported sheet mica and mica splittings; likewise the sales of by-product iron-free silica sand made by the feldspar flotation plants and the output of the American Vermiculite Co.'s plant in Spruce Pine.

The general outlook for the area is for continued good business, despite present uncertainties. Local minerals are expected to be in great demand during the national emergency. The kaolin, or china clay, plants of the region are running at the highest rates on record. Over a third of the local output of kaolin is going into making fiber glass and similar products as a substitute for aluminum hydrate. The fine mica which is a by-product of the kaolin recovery has become a main factor in the operation of the kaolin plants, now running 18 shifts per week, and is likely to be rated as an essential commodity in the emergency.

The outlook for both dry-ground mica and wet-ground mica is also excellent. Over 70,000 tons of the former is produced locally per year, an increase of over 1000% in 15 years. Most of the increase comes from capacity installed since 1943, 20,000 tons of it in the last year. Makers of roll roofing are the chief users.

Feldspar production in the Spruce Pine area in 1950 exceeded the 1949 total considerably, and possibly the recent total of 1948. In 1949 the local mills sold 159,768 tons of ground feldspar out of a total national production of 386,707 tons. The 1948 production was 219,720 tons shipped, out of a total for the nation of 506,451. The district's proportion of the total United States feldspar production in 1950 is likewise estimated to have been at least 48% greater than ever before. Half the local feldspar goes to glass makers, mainly to those making containers. The balance is used chiefly in making whiteware ceramics.

This trend toward higher output is expected to continue due to the increased production of plants in the district that are recovering feldspar (also by-product fine mica and iron-free silica sand) from local alaskite by froth flotation. These plants are shipping more than half of the district's output.

Strong demand for the fine mica obtained from the alaskite rock and a market for the silica sand have enabled the flotation plants to sell feldspar for glass containers at a low price which is at about the depression levels of the thirties. Competition from materials that can be substituted for feldspar in making containers is severe and only the use of flotation has saved the local industry's market in that line.

Probably the most serious competitor of the local feldspar is nepheline syenite. This can be used to replace 1.5 tons of feldspar for each ton used. Fairly high-grade deposits of it occur in Ontario as close to the

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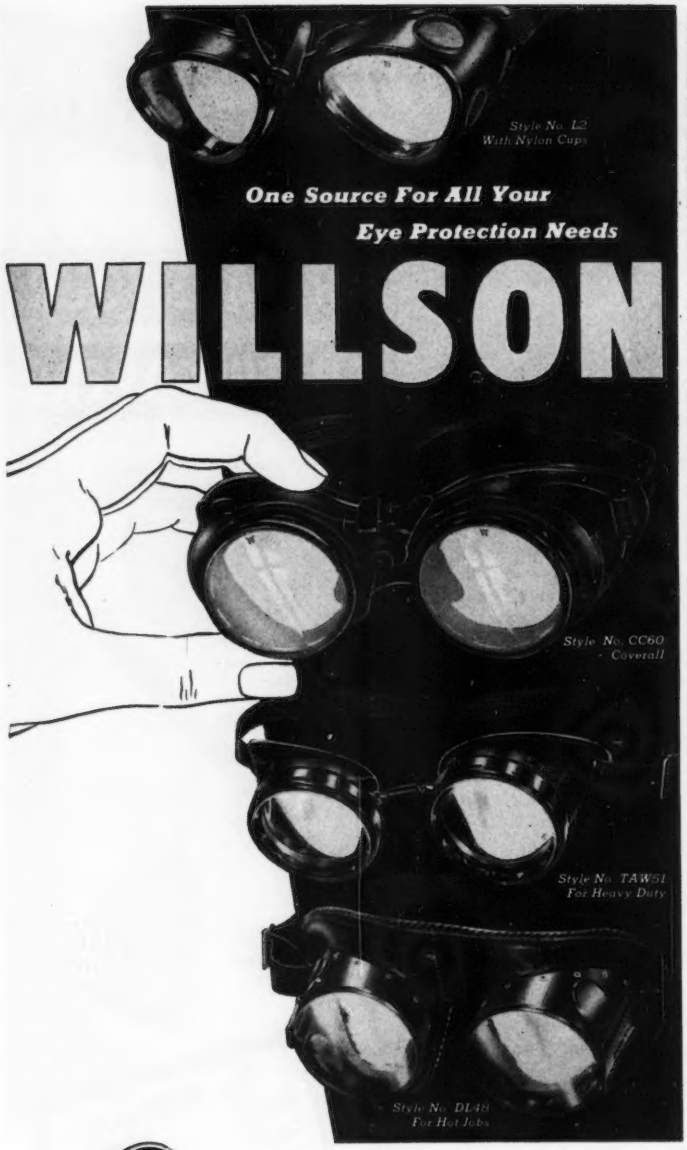

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North Carolina *(Continued)*

principal container-making areas as Spruce Pine is. Thus it has a substantial advantage in freight rates. It also can be imported duty-free as common sand. At the year end, 7,000 tons of nepheline syenite was coming in from Canada monthly, or at an annual rate that would replace 126,000 tons of feldspar.

OREGON

★**A pilot plant is being operated** at Scappoose, on the lower Columbia River, by James Orr to activate limonite used in desulphurizing manufactured gas. Limonite mined near Scappoose is being used. A larger plant is being built to replace the pilot plant.

★F. W. Libby, director of the State Department of Geology and Mineral Industries, has urged the State legislature to furnish funds to speed up Federal Government assisted topographic mapping as well as the department's work in ore exploration.

TENNESSEE

★One of the largest electric furnaces ever built and the largest to be used for making elemental phosphorus was put into operation Jan. 1 by **Monsanto Chemical Co.**, at its plant at Monsanto, Tenn., near Columbia. The new furnace is rated at 25,000 kw. and brings the number of electric furnaces in the plant to six. The six total 120,000 kw. This plant runs chiefly on low-grade phosphate muck, mined locally and washed and sintered at the plant before being furnaced. Some washed phosphate rock is also brought in by rail from the Florida pebble field and used for furnace feed. E. J. Bock is plant manager.

★Approximately 2,000 employees of the **Tennessee Copper Co.** have been granted an across the board increase of 11c. in their hourly wages. Retroactive to Oct. 13, 1950, the increase moves the minimum wages at the plant to $1.18 an hour.

TEXAS

★**New and faster methods for analyzing iridium, ruthenium, osmium and platinum** have been developed by University of Texas graduate students. Researchers developed the new methods by using a spectrophotometer to accurately measure intensity of a given wave-length of light. The alloy to be analyzed is dissolved in a special solution and a wave length of light is chosen which the platinum metal being sought will absorb. With the spectrophotometer,

a known amount of light is then passed through the solution. By measuring the light's intensity, it is determined how much platinum metal has absorbed and, therefore, how much of the metal is in the alloy. The University's research program, headed by Dr. Gilbert H. Ayres, chairman of the chemistry department, is receiving financial support from the Atomic Energy Commission.

UTAH

★Federal officials have reported in Salt Lake City that the Indian Bureau has ruled the members of the Navajo tribe may **reassign mining permits** presently held by individual Navajos. Under previous regulations, Navajos who were granted mining permits on the reservation in Utah, New Mexico, and Arizona were forbidden to reassign them. The Navajo Tribal Council asked for and received a relaxation of the restriction on the ground that individual Indians lacked the technical know-how and funds to develop uranium deposits known to exist on the reservation. The Indian Bureau action is expected to permit development of such deposits by experienced mining companies.

★The **Kalunite plant** in Salt Lake City, originally erected during World War II as a $5-million project for the production of alumina, has been acquired from J. R. Simplot, Pocatello businessman, by the Vitro Chemical Co. at an undisclosed figure. The facilities, covering some 80 acres in the southwest sector of the city, are being converted immediately for the extraction of uranium and vanadium from Utah and Colorado Plateau ores. Officials of the company report rehabilitation work now under way should permit processing of ore by late February or March.

While officers of the new corporation are "not prepared to discuss processes to be used" in ore treatment, it was stated that S. R. Zimmerley, who heads the Salt Lake branch of the U. S. Bureau of Mines, "contributed substantially to the solution of metallurgical problems in extraction of uranium oxide from Utah ores."

★An application before the Utah Public Service Commission by the Utah Natural Gas Co. which seeks to construct a **$32-million transmission pipe-line system** from southeastern Utah to the Salt Lake City region brought favorable response from spokesmen for refineries, smelters and mining machine manufacturers in the area. In the past, wintertime curtailment of natural gas supplies in the Salt Lake Valley has adversely affected operations of such mine-connected industries.

★Moderate early winter weather has permitted unexpected speed in construction of **Howe Sound Co.'s cobalt**

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By replacing a 30-year-old battery of three steam-driven gas exhausters with a new, high-capacity, electrically-driven R-C unit, important advantages were gained, in a large industrial plant:

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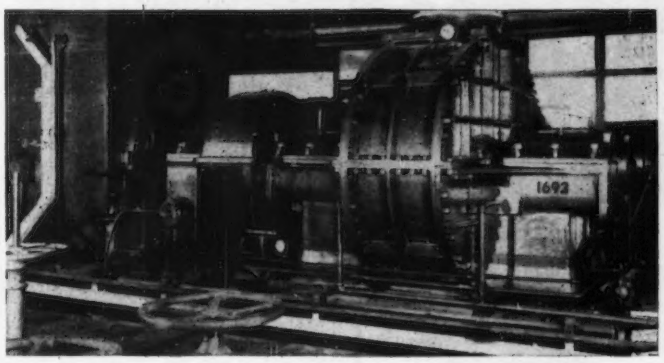
These very satisfactory results were obtained by careful evaluation of all the factors before deciding upon the type of equipment . . . and then by specifying an R-C Rotary Positive Gas Exhauster that will do the work at low operating cost.



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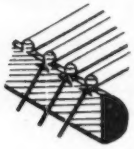

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Utah *(Continued)*

refinery at Garfield. The main structure, 100x129 ft. and 42 ft. high, of steel, concrete and corrugated siding construction, was virtually "closed in" by Jan. 1, according to Utah Construction Co. spokesmen. The refinery will handle 600 tons of cobalt concentrates daily from ores mined at Forney, Idaho. As much as 2,000,000 lb. of cobalt may be produced annually, giving the nation its first substantial domestic supply when operations begin in late 1951.

★Curtailment of civilian use of natural rubber is having the curious effect of booming one Utah mining operation, the **production of gilsonite.** Mined in the region of Bonanza and Eureka in Uintah County, it is widely used in the manufacture of asphalt-based floor coverings and is a substitute for rubber in the manufacture of battery cases. It is also used in paints and lacquers.

The American Gilsonite Co., subsidiary of Standard Oil Co. of California, controls over three-fourths of Utah gilsonite production.

★W. H. H. Cranmer, president of New Park Mining Co., has reported that ore has been encountered on the west drift from the company's Mayflower fissure on the 1,505-ft. level. A face of ore is now being developed in the New Park ground in the Park City district. At the same time, according to Mr. Cranmer, high values, particularly in gold, have been encountered at the Pearl fissure in depth. New Park is currently completing a new high-speed hoist which is expected to materially speed production at the property.

★The Atomic Energy Commission has awarded a contract for **exploratory drilling** in the Marysvale uranium region to Boyles Brothers Drilling Co., of Salt Lake City. The bid was $83,860 on the basis of 10,700 ft. Three complete units for core and non-core surface drilling were to be utilized in tests, scheduled to begin in January.

WASHINGTON

★The new 800-ton unit of **Pend Oreille Mines & Metals Co.'s** projected 2,400-ton mill near Metaline Falls, began tuning up the first part of December and the first concentrates were loaded for shipment to the smelter at Kellogg, Idaho, the last week in December. The second unit is expected to be completed during the first half of the year, and the third operation before the end of 1951.

★**An old timers get-together banquet** was to be held at the Spokane Hotel in Spokane on Jan. 13, plans being made by Northwest Mining Association at the suggestion of Sidney Norman, of Calgary, Alta., who feel that the meeting might be made an annual affair.

★**Mines Management, Inc.,** moved its crews early in Dec. from its Advance mine near Northport, to its Iroquois property where underground work can continue through the winter, according to President W. Randolph Green.

★**Northwest Gypsum Co.** was reported ready to start operations at the mouth of Rock Creek, near Weiser, Idaho. Dr. F. M. Handy of Spokane developed the company which is said to have at least 1 million tons of gypsum. The 8-mi. road to the Union Pacific Railroad at Huntington was reported to be nearly completed.

★**Admiral Consolidated Mining Co.** which operates north of Leadpoint, has received net smelter returns since resuming production in the fall of $26,906, not including payments of two shipments of zinc concentrates to the Trail smelter, Mrs. J. Richard Brown, secretary-treasurer reported. Concentrates have averaged more than 60% zinc, about 2% lead, and ½ oz. silver per ton.

★Washington State College's experiment station and Bonneville Power Administration are working together in an electrical method of turning out **manganese dioxide** from ores of the Northwest.

FINDS BEST SOURCE . . .

. . . of Buying Information

There is a wealth of product information pre-filed between the covers of the McGRAW-HILL PRE-FILED MINING CATALOGS. Mr. H. B. Chessher, President of the Central Comstock Mines Corp., Virginia City, Nev., and General Manager of Chessher & Company's Juniata Mine at Aurora, Nev., knows that when product information is needed on machinery, equipment and supplies he has the necessary data at his fingertips in this Catalog. A comprehensive Directory of Manufacturers, which lists all known manufacturers of mining equipment, with their business address, is included.

In a recent letter Mr. Chessher said: *"The Catalog is the best we have seen."* If PRE-FILED MINING CATALOGS is not available for buying reference at your mine write to McGRAW-HILL CATALOG SERVICE, 330 West 42nd Street, New York 18, N.Y. There is no charge to qualified users.

★Kaiser Aluminum & Chemical Corporation announced plans Dec. 29 to install smoke and fume controls at its **Mead aluminum reduction plant.** Norman Krey, in charge of the plant, declined to give figures but it is reported that the cost will be about $3 million.

★**Grandview Mines, Inc.,** with a zinc-lead property near Metaline Falls, was to pay 1c. a share dividend Jan. 20, which would amount to about $28,000. James L. Leonard, president of Metaline Mining & Leasing Co., was elected in December to fill a vacancy on the board of directors.

★**Sullivan Mining Co.** in drilling into the wall of the 4-ft. thick zinc ore body in the Metaline contact property disclosed 18 ft. of ore, according to James L. Leonard, president of Metaline Mining & Leasing Co. He reported the new work showed that just the edge of the orebody had been cut.

★Field headquarters for the Defense Minerals Administration was established in Spokane early in December. A. E. Weissenborn of the U. S. Geological Survey is in charge. M. E. Volin, chief of the mining division of the U. S. Bureau of Mines at Moscow, have been named to the staff. G. C. Reed of the Albany regional office is serving in Volin's place while he is out of the country. Mr. Weissenborn said the office staff would eventually grow to about 25.

★Kaaba silver-lead-copper-zinc mine near Nighthawk is being reconditioned. It was reported that work was to begin in December on a 1,500-ft. shaft and work was to begin in new parts of the mine.

★New officers for West Coast Mineral Association at Seattle for 1951 are: Harry Townsend, president; O. H. Solibakke, vice-president and W. A. Richelsen, secretary-treasurer. Dean Milnor Roberts retired as president.

BOOKS RECEIVED

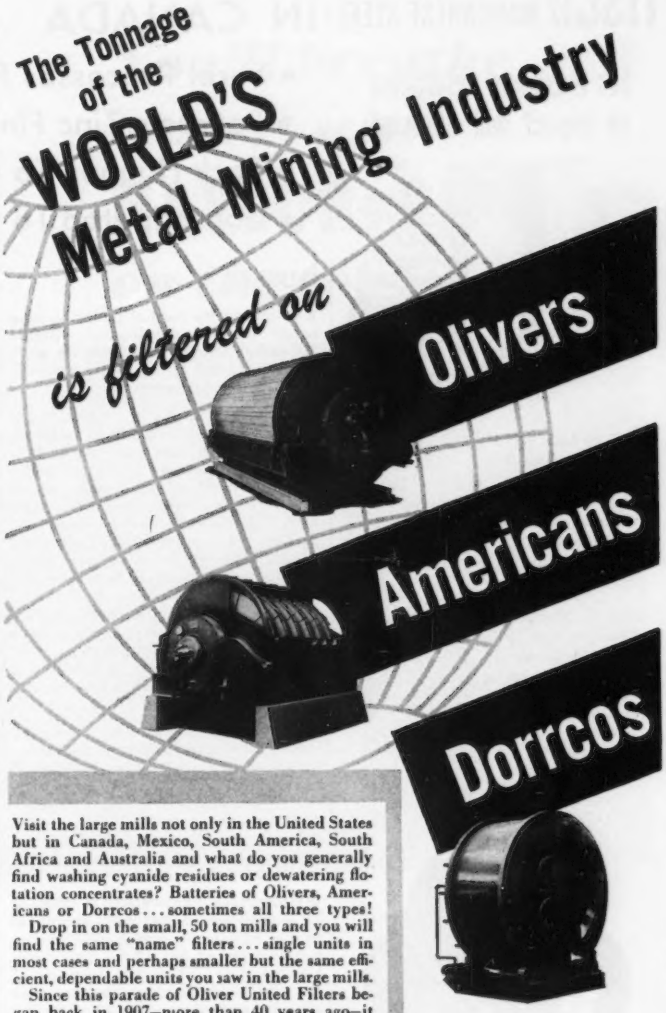
The following publications may be obtained from the Bureau of Mines Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.

R.I. 4683. Generation and Propagation of Strain Waves in Rock-Part I. By Leonard Obert and Wilbur Duvall. Pp. 19 with numerous graphs and tables.

I.C. 7567. Electrical Blasting at Miami Copper Co., Miami, Ariz. By Allen D. Look and Ernest R. Rodriguez. Pp. 19.

R.I. 4703. Investigation of New Galena Lead Deposit, Busks County, Pa. By Kenneth M. Earl. Pp. 7.

R.I. 4696. Investigation of Smuggler Lead-Zinc Mine, Aspen, Pitkin County, Colorado. By M. E. Volin and J. H. Hild. Pp. 47.



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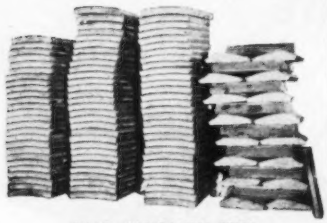

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- Sorel Processes First Titanium Ore
- Barvue's Zinc Find Steadily Widens
- Teck-Hughes To Close This Summer
- Consolidated To Spend $15,000,000

QUEBEC

★Following its normal policy of long range forward development, **Sigma Mines has started deepening its main shaft** by 1,000 ft. to below 3,000 ft. to open another seven levels.

★Lamaque Gold Mines, is also working well ahead. **The mill is to be increased by 500 tons** this year and by 1952 will be treating 2,000 tons daily.

In preparation the management has 2 shaft-sinking projects under way. A 4-compartment winze will be put down from the 2,400-ft. level to the 3,600-ft. level for use as a service and development opening which will free the main No. 7 shaft for ore hoisting. A new surface shaft will be sunk to open Lamaque's extension of the main Sigma zone. It will be taken down to 1,200 ft. in the first operation with stations for eight levels.

★**Fast progress has been made by Barvue Mines** in extending the known dimensions of its big indicated zinc-silver orebody in Barraute twp. One of the sensations of 1950, this prospect already shows close to 2 million tons of ore averaging better than 3% zinc and half-ounce silver, with no limits yet reached.

★**Widespread exploration** is planned by a number of Barvue's neighbors in the new camp, which was staked solidly last fall but where little work was possible due to the lateness of the season. Surface drilling has already started on the property of Pershcourt Mines, immediately adjoining to the north.

★**New exploration bet** in Dasserat twp., some distance west of Noranda, is probing for copper. Interested companies are Violamac Mines and Golden Shaft Mines. The former has 24 claims and the latter 12.

★Feature of 1951 will be the **resumption of work on O'Brien Gold Mines' Bachelor Lake gold prospect,** where good tonnage and grade were indicated several years ago in surface drilling. Underground work has been held up by lack of transportation facilities, but these are available now that a road has been constructed into the area by the Quebec government. Canadian Malartic Gold Mines enjoyed in 1950 its best year since 1945. Profits will be slightly above the 5.7c. earned net in 1949, for the mine produced more gold than in any previous year.

★The first of 5 furnaces at **Quebec Iron & Titanium's Sorel plant** has begun processing ore from the Lac Tio deposit of the Allard Ladevelopment. The plant will handle 550,000 tons of ilmenite ore when it reaches full scale operation in 1952. Products will 250,000 tons of slag containing 70% titanium dioxide and 200,000 tons a year of iron.

Development of the project is costing Kennecott Copper about $20 million and New Jersey Zinc about $10 million. Construction of the Sorel plant as well as the difficult railroad from Lac Tio 27 miles away, was carried out by Fraser-Brace Co., a firm of design engineers and constructors.

ONTARIO

★**Reflecting record production,** net earnings of Cochenour Willans Gold Mines in 1950 were the highest in its history. Estimated net, before cost-aid, was $451,000. This amounts to 15.23c. per share compared with 6.79c. in 1949.

★**Ontario's oldest gold camp is** undergoing a new test, drilling having been started on the property of Ackerman Gold Mines near Marmora, Hastings County. The property's mining history goes back to the 1860's but no successful chapter has yet been written. New geological and metallurgical theories, however, give hope that modern mining methods may write a different story, and new capital has been raised to give them a try-out.

★Leitch Gold Mines in the Sturgeon River area, **continues to develop excellent ore** on its new deep levels below the diabase sill. The end of 1950 saw more than five years' ore in place, of which two-fifths is in the deep horizons. The bottom level (19th, at 2,875 ft.) is fully developed and shows as much ore as any other in the mine.

★During the coming summer **the end will probably come for the Teck-Hughes** gold mine in Kirkland Lake. **After a remarkable history** that spans almost 40 years the old veteran is succumbing to rising costs and the adversities of mining for-

tune at depth. Most of the milling equipment will be left intact for a while, at least, against the possibility that improved conditions may permit further mining, but part will be moved over to the Lamaque mine in Quebec where a 500-ton mill expansion is being planned.

★Encouraged by better lead-zinc prices, **Geneva Lake Mines has resumed surface drilling** at its Hesse twp. property in the Sudbury district. A former producer, milling was stopped years ago with some 61,000 tons still in place averaging 10% zinc and 3% lead, with additional values in gold and silver. A modest amount of work was done under new sponsorship a year ago, but the start of exploration work was postponed until early this winter.

★Dome Mines, gold producer of the Porcupine area, **has further diversified its interests** by optioning control of Mindamar Metals Corp. Mindamar holds the former Stirling mine on Cape Breton Island, Nova Scotia. Inactive for many years, this former lead-zinc-copper producer is known to have 200,000 tons of ore in sight averaging 9.6% zinc, 2.3% lead, and 1% copper, with additional gold and silver values.

★Pickands, Mather & Co., acting for certain steel and iron ore producers, is negotiating with Steep Rock Iron Mines, Ltd., for exploring and securing an option on an iron ore area of more than 1,000 acres at Steep Rock Lake, Western Ontario, in the vicinity of the property which Inland Steel is exploring. Others of the group are Bethlehem Steel, Youngstown Sheet & Tube, Steel Co. of Canada, Ltd., and Interlake Iron Corp.

★**Another small base metal producer** has been added to the Ontario list, Ryan Lake Mines having started shipping copper-gold-silver concentrates to the Noranda smelter. It is hoped to maintain shipments at the rate of a carload per week. Ryan Lake, with property in Matachewan, has a mill with capacity of 75 tons daily. All production comes from the open cut, but the shaft has been completed to 150 ft. and officials are hopeful that the results of lateral work will justify increasing capacity to 200 tons.

MANITOBA

★Mineral production in Manitoba for 1950 officially estimated at $31,500,000, compared with $23,839,638 in 1949. Gold, copper and zinc were the three metals which showed the largest increases. Three contributing factors to the record mineral production were; higher prices for base metals; more ore mined from the Manitoba side of the Flin Flon orebody by Hudson Bay Mining and

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Canada *(Continued)*

Smelting Co., Ltd.; the first full calendar year of production by the Howe Sound Exploration Co. from its property at Snow Lake.

★Hudson Bay Mining and Smelting Co., Ltd., is among 238 firms throughout the U. S. and Canada which are being awarded "Certificates of Management Excellence" for the year 1950 by the American Institute of Management, New York.

★Falnora Gold Mines, Ltd., recently formed to develop a gold prospect at Falcon Lake in southeastern Manitoba, reports options have been granted on 1,000,000 shares at prices ranging from 10c. to 25c. per share. Authorized capital is 4,000,000 shares, of which 1,333,338 have been issued.

★Ogama-Rockland Gold Mines, Ltd., reports no appreciable change in the ore situation. Unless more ore is found on existing levels, milling can be maintained for a few months only. November output amounted to $34,200 from the milling of 3,653 tons.

Coming Next Month:
Hollinger's Management Formula

BRITISH COLUMBIA

★Value of mineral production in British Columbia jumped $4.5 million in 1950 over the 1949 figure, according to the annual year-end provincial government preliminary estimate.

★Higher costs are threatened for British Columbia mines in a notice served by the International Union of Mine, Mill & Smelter Workers that the union will seek higher wages because of the government's indications of income tax boosts due this coming spring. The move was advocated in an executive report to the 8th annual district convention at Vancouver in December.

★Later in the month, an interim wage increase of 7½c. an hour, effective in June, was announced for 4,000 workers by Consolidated Mining & Smelting Co. of Canada. The boost will apply to all regular employees at Trail, Kimberley, Calgary and certain other operations.

★A conciliation board dealing with the Pioneer Mine labor contract has recommended $8.88 a day for miners, with no paid statutory holidays. The union is asking $9.50 a day for miners who are presently getting $8.26 and an interim bonus of 34c., pending present negotiations.

★A Christmas bonus of $75 was granted employees of Consolidated Mining & Smelting Co. at Trail, Kimberley and other operations.

★Consolidating Mining & Smelting Co. of Canada has announced con-

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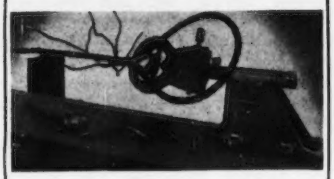

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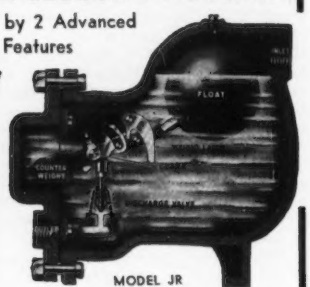

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struction of projects totalling $15,000,000 at its plants in British Columbia. The company will build an addition to its Trail electrolytic zinc refinery at an estimated cost of $3,200,000, to increase production of refined zinc by about 70 tons a day. The company also will increase its fertilizer production by building a $9 million plant at Kimberley, with a capacity of 70,000 tons of ammonium phosphate annually. The new Kimberley plant will include a unit to treat tailings from the company's Sullivan mine to produce around 300 tons of sulphuric acid.

★A good deposit of magnetite iron ore has been found on the property of Quatsino Copper-Gold Mines, Ltd., at the northern end of Vancouver Island. First diamond drill hole in a program to test the downward extension of surface showings penetrated a 20-ft. width of solid ore of better than commercial grade. Sampling of the drill core showed iron ore with low sulphur, phosphorous and titanium impurities occuring as a replacement in limestone. The first hole had to be discontinued because of a power shortage. A deeper hole from the same station is being drilled and others will be drilled at 100 ft. intervals.

★Sunshine Lardeau Mines, Ltd. will install a 50-ton daily mill at the Spider mine (base metal) near Camborne, following satisfactory diamond drilling results. A diesel-electric plant also will be purchased. The company has acquired 30 mineral claims, taking in about 1,500 acres in the Trout Lake area, Lardeau mining division.

★Silbak-Premier, Ltd. has encountered high grade gold-silver-lead-zinc ore in diamond drilling to locate the downward extension of ore on the Northern Light property of Premier Border Gold Mining Co., which adjoins Silkak. Results of drilling so far are insufficient to plan extraction. Silbak-Premier has an agreement with Premier Border to develop and operate the claims, with a 50-50 division of profits to be made every six months.

★Indian Mines, Ltd. has suspended operations on its new aerial tramway in the Stewart district because of heavy snow.

★Selkirk Mining Co., Ltd., operating in the Slocan, is negotiating for a short-term lease on the 150-ton mill of Kenville Gold Mines, Ltd., near Nelson. The plant will be used to treat zinc and lead ores from the Jackson mine.

★Highland-Bell, Ltd., silver-lead-zinc producer on Wallace Mountain, near Beaverdell, hopes to return the old Bell property to production soon. Diamond drilling has picked up a number of good ore intersections in the mine.

★Santiago Mines, Ltd. is completing

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Canada *(Continued)*

installation of a new crushing machine and conveyor unit at its Bosun mine near New Denver in the Slocan mining division.

★Guichon Mine, Ltd., with new financing ample to bring its Copperado Mine, Nicola mining division, into production, is proceeding with development aimed at finding the size of mill required.

★Yale Lead and Zinc Mines, Ltd. Ainsworth district, is scheduled to go into production about March 1. Foundations have been poured for a 250-ton sink-float plant and a 125-150 ton concentrator is being erected. Easily available lead-zinc-silver ore in five groups is estimated at 201,000 tons, grading 3.1 oz. silver, 5% lead and 5.5% zinc.

★Ascot Metals Corp. has cut the first station in the shaft at its Suffield property and has resumed shaft sinking, with all surface installations completed for carrying out the underground development program.

★Hedley Mascot Gold Mines, former gold-mining operator in the Osoyoos district, plans to have the Silver Giant mine at Spillimacheen in production by February, using the former Mascot gold mill. Once in production the operation will be taken over by Giant Mascot Mines, Ltd. a company owned 55% by Hedley Mascot and 45% by Silver Giant Mines.

★Cronin Babine Mines, Ltd., with funds fully underwritten to put its silver-lead-zinc operations near Smithers on a milling basis by spring, is starting shipments of ore from its Cronin and Debenture mines to Trail smelter.

★At Base Metals' Cork-Province mine at Kaslo a raise started in the west end of the 506 vein on the 5th level in the hanging wall ore zone has returned an average from muck samples of 6.6 oz. silver; 6.1% lead and 5.7% zinc.

★At the Base Metals controlled Vancouver Island Base Metals property, near Duncan, V. I., property preparations for production are continuing with ore being opened above the 265 ft. level. The 150-ton mill is expected to be in production by the end of March.

★Western Uranium Cobalt Mines, Ltd. will carry out further intensive development of its Victoria claims in the New Hazelton area in 1951, following satisfactory results last year. The work will proceed simultaneously with the opening up and placing in production of the company's adjoining Rocher de Boule copper-gold-cobalt claims.

★Meanwhile, Western Uranium has taken another major expansion step by securing an option on nine claims in the heart of the Eldorado at

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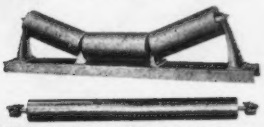

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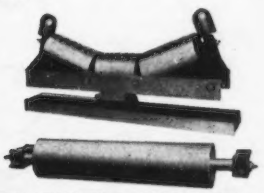

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IDLERS

Beaverlodge Lake, Saskatchewan, adjoining the property of Nesbill Labine Uranium Mines, Ltd.

★**Carnegie Mines, Ltd.** reports good progress in reconditioning the Silversmith at Sandon. The 3,000 ft. No. 10 main haulage adit has been retimbered where necessary, and the hydro-electric power plant and main airline from Sandon to the mine have been overhauled.

★A hydro power agreement, which reportedly makes almost certain the establishment of a $500 million aluminum industry in Britsh Columbia, has been signed by the British Columbia government and the Aluminum Co. of Canada.

★The contract is subject to ratification by the provincial legislature, which meets in February, and details will not be known until it is placed before the house.

★Three mines are tied in with **Western Exploration Co., Ltd.,** 250-ton mill at Silverton, following completion of the tramline connecting the Mammoth mine with the plant. Silver-lead-zinc ore is also drawn from the Enterprise mine, where development, as at the Mammoth, is well advanced. At the third mine, the Standard, development is nearing the stage providing for steady production.

★Canadian Exploration Ltd.'s **Jersey lead-zinc mill,** former Emerald tungsten producer near Salmo, handled 37,124 tons averaging 1.86% lead and 6.42% zinc for production of 5,010 tons of concentrates in the three months ending Sept. 30. New smelter returns amounted to $642,000.

★Hamil-Silver-Lead Mines, Nelson, has begun **underground operations** and expected to have sufficient ore on hand from development headings to ship to Trail smelter by December. Extension of the drift on the main vein to an estimated 140 ft. to connect with an incline shaft, driven by former operators, is planned.

★Site for the new 100-ton mill at **Base Metals Mining Corp.'s Cork-Province property** at Kaslo has been cleared, and major items of machinery, along with lumber, purchased. Erection of the mill is proceeding as quickly as possible, with the plant expected to be in operation by April of 1951. Milling rate is expected to be 2,500 tons monthly. Average grade of reserve ore is 4 oz. silver, 5.4% lead and 8.3% zinc. Meanwhile, sampling of backs for a length of 129 ft. in the 506 drift on the 5th level in the hanging wall ore zone averages 5 oz. silver, 7.4% lead and 6.2% zinc across an average width of 8.9 ft. Drifting is continuing on the new 6th level.

★Estella Mines, Ltd., near Wasa in the East Kootenay, expects delivery of equipment for its **new 150-ton mill** to permit production by June, 1951. Concurrent with this construction, development underground has been going ahead on schedule.

★Western Uranium-Cobalt, near New Hazelton, is planning a **150-ton mill** that may make the mine the third copper producer in B. C., according to company officials, who report there is sufficient ore on the Rocher De Boule claims to warrant construction of a mill. A hydro plant has been purchased and the mill is expected to be installed next spring.

★A **$40,000 perlite crushing mill** will be built at Francois Lake, northcentral B. C., next spring by Western Gypsum Products, Ltd. Large deposits are reported at the property, and a road already has been built to the mine, 19 miles from Burns Lake, nearest shipping point.

YUKON

★**Yukon Consolidated Gold Corp.,** Ltd., operating in the Klondike, had recovered $2,500,000 in gold during 1950 to the end of October, compared with a total of $2,173,405 for the full previous year. Gold recovery in October was $407,000, compared with $454,000 in September and $439,000 in August.

★**Consolidated Yukeno Mines Ltd.'s** silver-lead-zinc properties have been taken over for operations by Byron W. Newkirk & Associates of Toronto and Montreal, who also control the major portion of shares.

★**An iron ore deposit** is said to have been discovered in a 550-mile field extending from Ogilvie Mountains to South Nahani River. H. S. Bostock, government engineer of Vancouver, B. C., said some samples from the area appear to be "similar in quality and grade to the Lake Superior iron ores." The possibility of this leading to the development of a steel industry in British Columbia is under speculation.

★Chuck Herbert, director of a group **operating on Big Gold in the Sixty-mile district,** shut down operations late in October after what he termed "a very good year." A dragline was used through the season and the dredge operated about two months. Operations on a similar scale are planned for 1951.

SASKATCHEWAN

★Discovery of potash beds containing an average of 12.7% potash over ten feet thickness in a new area of the province was announced by Hon. J. H. Brockelbank today. As on previous occasions the potash zone was encountered during the drilling of a well for geological information in the current search for oil in the province. Samples taken over a narrower 4'-3" section of the ten foot bed showed an average potassium oxide content of 16.1%. This is probably of commercial grade judged by European standards.

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IN LATIN AMERICA

ARGENTINA

★The steady **rise of tungsten price** has promoted interest among former wolfram producers in the country. Re-opening of several mines closed down at the end of World War II is now being considered. Chief drawback is government policy in the matter of exportation exchange rates and permissions.

The preferential exchange rate of 7.50 pesos to the dollar granted by the Plan de Fomento Minero is not considered attractive enough and it is expected that the government will fix a better one nearer to the free-exchange type about 14 to the dollar.

During the last war peak production of Argentina was 2,100 tons of concentrates over 65% WO_3.

★The National Congress has authorized an increase in capital of Sociedad Mixta Siderurgica Argentina that the government will consider convenient for developement of the plan. This measure will push forward the installation of the blast furnace and steel mill of San Nicolas on the Parana River.

★The Banco de Credito Industrial has decided to **establish buying agencies** in eight mining districts of the country. The Bank will pay the best prices for ores and concentrates on the basis of foreign market quotations, deducting no more than 3% of the value for operating expenses.

CHILE

★Nitrate and Iodine Corp. has contracted to sell the Italian Government 50,000 tons of **sodium nitrate** for £700,000 in Italian goods.

★Congress has passed a bill authorizing the **Chilean Mining Bank** to raise a loan for 100 million pesos to improve its financial position so that it can pay miners promptly for ore it buys. The new law also directs the Bank to build a 30-ton cyanide mill in the Illapel Department to avoid the long railroad haul to Domeyko mill.

★Corporacion de Fomento's (Chilean R.F.C.) budget for 1951 has earmarked 45 million pesos to begin building **two electrolytic refineries,** one for coppor and one for zinc. The exact location for the two refineries has not been fixed yet.

The value of the ores and concentrates exported by the Mining Bank in 1950 amounted to almost $2 million. The Bank in the same year bought ores, concentrates and metal-

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lic gold from the miners valued at 367 million pesos.

The Government has estimated that for 1951, Chile's exports returnable to the country will amount to $251 million. Copper will account for $105 million; nitrate $40 million; iron ore, $1 million; from the small and medium-sized mines, $16 million; oil $3 million; pig iron and steel $8.6 million; and copper in manufactured forms $12 million. Mining and metallurgy will account for 75% of all Chilean visible exports which has been an average figure for many years past.

★On Nov. 23, **Chuquicamata mine** succeeded in breaking a record which had been standing since Jan. 24, 1945, by loading into cars 106,982 tons of ore and waste.

★An improved system of transfer raises at the **Braden mine** has allowed the company to do away with the old camp known as "Teniente C" which years ago used to house up to 2,500 men. All men from Teniente C are now living at Sewell which is at a lower elevation and where the mill is located.

★**The Mining Society of Chile** held a mining convention in Santiago, Dec. 14 and 15, which was attended by all the presidents of the mining associations affiliated with the Society.

At the closing session the **following resolutions** were approved:

Paipote smelter—That the Government appropriate in the 1951 budget 245 million pesos to finish the construction of the smelter and furnish it with the necessary working capital to lay in a stock of ores and concentrates for three months operation. Also that the Government provide the necessary funds to mechanize the port of Caldera; fix the railroad from Calders to Paipote and buy the necessary rolling stock for this railroad.

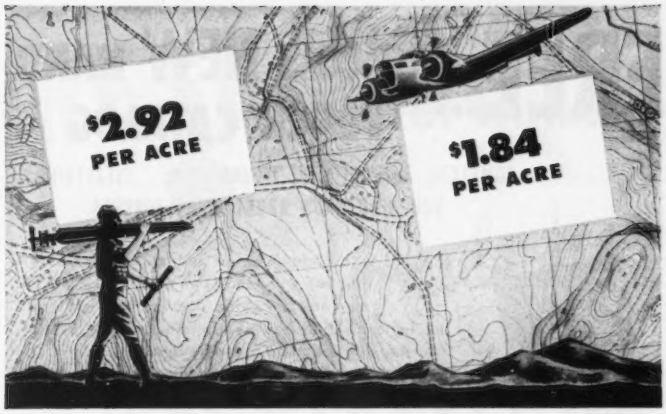
Mining Bank—That the capital of the Bank be increased to 1 billion pesos.

Gold Law—That this law be maintained in consideration of the good services it has rendered the mining industry and the country.

Foreign Exchange—A vote of thanks was given to the Government for the new law regulating foreign exchange sales which allows small and medium-sized mines to sell their exchange in the free market.

A Single Tax for the Mining Industry—That all present taxes that the mining industry has to pay be incorporated into a single tax amounting to 1.5% of the value of mining products sold.

★**The new copper-gold flotation mill** of Cia. Minera Delirio de Punitaqui was inaugurated on Dec. 17 by the Secretary of the Interior Señor Pedro Enrique Alfonzo. The mill treats 80 tons a day of 3.5% copper ore making a 25% copper concentrate containing 0.3 oz. of gold per ton and a pyrite concentrate running 48% sulphur.



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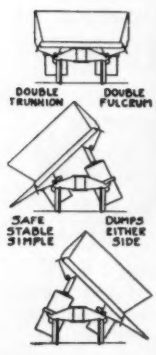

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MEXICO

★Effective January 1, **production tax on minerals** was calculated on a new basis. The new law states that the tax shall be figured at the rate of 4.85 pesos to the dollar and eliminates the complicated system whereby the tax was calculated at existing exchange rates. The producer then had to cover the increment resulting from exchange differentials over previous rates. The credit was used in lieu of export duty or surtax.

★**Influx of foreign capital** into Mexico in the last few months has raised the country's dollar reserve to nearly $300 million. Considerable speculation that the peso would be re-valued upward has been denied by government authorities concerned with the problem.

★**A strike** has shut down the Mexican silver mine of "La Azul" in Taxso. Miners are asking a revision of their contract and salary increases.

IN AUSTRALIA

★Australian price-control authorities have made two further concessions to the buoyant international metal market and have permitted domestic producers to **increase the selling price of tin** from 74c. to 84c. and that of copper from 19½c. to 23c. a lb. These prices are much closer to international parity than those allowed for lead and zinc, which for several months have remained fixed at 6½c. a lb.

Maximum uniform price of tin to Australian consumers has been set at $1.15, 35c. higher than the last ruling price. It is based on the pooled cost of local and imported tin. The copper price to consumers is the same as that paid to producers.

WESTERN AUSTRALIA

★Stockholders of Gold Mines of Kalgoorlie, Ltd. have agreed to the formation of a **new company, Kalgoorlie Southern Gold Mines N.L.** It is to acquire leases from Gold Mines of Kalgoorlie to the south of its mine. The leases cover 2,880 acres. There will not be any public issue of shares, but capital will be subscribed by Gold Mines of Kalgoorlie and member organizations.

★A **new five-compartment shaft** for North Kalgurli (1912) Ltd. southern group of leases will be 25½x5½ ft. inside timbers, making it the third largest in Western Australia. Two skip compartments will be 5½x5½ ft. and will be used to hoist self-dumping skips of 5-ton capacity at 1,000 ft. per min.

★Central Norseman Gold Corp. N.L.'s

Princess Royal shaft has intersected a rich reef at 403 ft.

NORTHERN TERRITORY

★Claims that no gold mine in Australia in the past 50 years could compete with the **Nobles Nob mine** of Australian Development N.L. at Tennant Creek, as far as consistent high values and yields are concerned, are fully borne out by production statistics. Since milling began in October, 1948, 19,407 tons of ore have been treated for 41,412 oz. The program of opening up the 215-ft. level to facilitate extraction of all ore above has been almost completed. It is now planned to open up the mine at depth. The weight of stamps in the mill is to be increased to lift treatment capacity by 200 tons monthly.

A new company, Drilling and Development, has been formed in Adelaide with a nominal capital of £100,000 to test leases in the Tennant Creek area. Ground has been pegged on the northeast boundary of the Australian Development lease at Tennant Creek.

VICTORIA

★Within the metropolitan boundaries of Melbourne, **a new gold-mining venture** is approaching the production stage at Diamond Creek. Golden Hind Mining Co. N.L., is rehabilitating the old Diamond Creek mine which was destroyed by fire in 1915. Plans include sinking of the existing shaft from 730 ft. to 955 ft.

★Harrietville (Tronoh) Ltd., operating what is claimed to be the **largest dredge in the southern hemisphere,** is not expecting any profit on current production as a large proportion of the ground dredged is tailings. By next June, however, the dredge will be in new ground.

★Another important contribution to Victorian gold production is expected from the Amphitheatre dredge of the **Central Victorian Dredging Co.** when it begins work in the new year. This dredge operated between Newstead and Strangeways for ten years. It was dismantled in 1948 and reassembled at Amphitheatre and has been subjected to extensive front-end alterations to increase its digging depth to 55 ft. It has a capacity of 2,000,000 cu. yd. a year.

TASMANIA

★Proposed recovery of the zinc content of the **Electrolytic Zinc Co.'s** plant residues, if it is successfully accomplished, may add significantly to the availability of rrw material for treatment in the zinc plant. The plant's capacity has been raised to 100,000 tons of zinc a year, but cannot be fully utilized until adequate supplies of concentrate are available.

Development of the West Coast mines is hampered by transport difficulties due to the isolation of the district. The company is now examining mineral areas on the mainland.

By arrangement with the price-control authorities, E.Z. is under obligation to release to the domestic market a quantity of zinc equivalent to 15 lb. per capita annually, compared with a previous consumption of about 12 lb. This concession had to be made in return for the recent increase of the domestic selling price of 6½c. a lb.

E.Z.'s capacity to increase sulphuric acid production from zinc concentrate will shortly reach its peak when the new units now under construction at Risdon are complete.

★**Mount Lyell Mining & Railway Co., Ltd.,** has expanded its fine-grinding section by addition of another ball mill and classifier.

★**Zeehan Mines Pty. Ltd.** has struck what appears to be a solid face of silver-lead ore, extending from the surface for hundreds of feet. It cut the silver-lead lode at the 300-ft. level.

★To speed drilling in hard ground, **Mount Morgan Ltd.** has experimentally substituted diamond drilling for churn drilling in open-cut work. Thirteen diamond-drill holes were sunk 35 ft., charged and fired in 30 man-shifts. Previously it had taken six weeks to put down two churn

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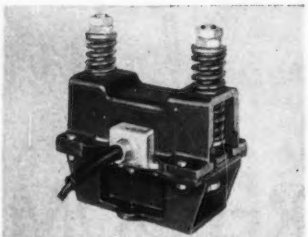

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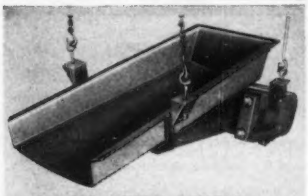

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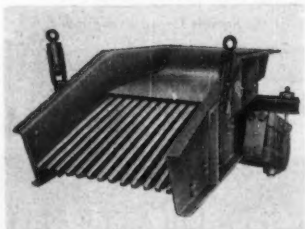

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Australia *(Continued)*

holes. The diamond-drill holes were 1 in. in diameter and were spaced 10 ft. apart under a 7-ft. burden. About 3,000 tons of rock was broken by simultaneous firing.

★Tin concentrate production of Tableland Tin Dredging, Ltd. in 1949-50 was 591 tons, compared with 484 tons in 1948-49. Estimated remaining life of the **Return Creek property** has been reduced to two years as a result of close boring ahead of the dredge. The company has acquired the Smith's Creek area, where 50,000,000 cu. yd. averaging 11.46 oz. are indicated.

IN AFRICA

★Progress of shaft sinking in the **new Free State gold mines** was reviewed by the chairmen of companies interested in the Free State at the annual general meetings of companies last month.

At Anglo-Transvaal Consolidated Investment meeting, B. L. Berstein, joint managing director, said that the three vertical shafts at the Virginia mine were down 1,175 ft., 1,573 ft. and 61 ft. respectively. The necessary machinery and plant to take each of the shafts to its final depths have been installed. No. 1 shaft, it is estimated, will intersect reef at 3,750 ft., No. 2 shaft at 3,100 ft. and No. 3 at approximately 1,450 ft. on the sub-outcrop.

No. 1 shaft at Free State Geduld has reached a depth of 2,824 ft. and No. 2 shaft 3,676 ft. Shaft sinking will be stopped temporarily in No. 2 shaft at about 4,200 ft., about 1,200 ft. above Basal reef to enable underground development to start towards No. 1 borehole on the farm Geduld 697.

The ventilation shaft at Harmony mine, also in the Free State, was sunk 306 ft. during November, surpassing the previous Free State monthly record for shaft sinking by 60 ft. The No. 3 shaft was sunk 271 ft.

★Nchanga Consolidated Copper Co., Ltd., Rhodesian Refineries, Rhodesian Anglo-American, Rhodesian Broken Hill and Rhokana Corp. have now had their shareholders approval to transfer their domicile from London to Northern Rhodesia.

★**Substantial contracts have been entered** into with overseas buyers for 1951, according to the acting chairman of South African Manganese, Ltd. Some contracts have been entered into for lower grades of ore not previously exported.

★Despite the huge task presented by a big and unskilled labor force on Reef mines, the **fatality rate for the Witwatersrand gold mines** was lower than the metal mines of the United

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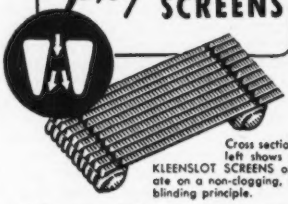

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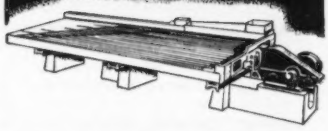

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States and only slightly higher than the mines of Britain, according to R. B. Hagart, president of the Transvaal Chamber of Mines.

★Jeanette Gold Mines, Ltd., the second of the two **Anglo-American companies** to operate in the Wit. Extensions block of the Free State, has been registered.

IN EUROPE

ENGLAND

★**Enough potash** to satisfy Britain's requirements for 140 years has been found in Northeast Yorkshire. At present, the United Kingdom is entirely dependent on foreign sources of potash, at an estimated cost of £6,000,000 annually. About 200,000,000 tons of KCl has been located by a drilling campaign over the last two years in the Eskdale district of North Riding. Lying at a depth of over 4,000 ft., the deposits consist of two flat-lying beds of sylvinite. No decision has yet been made as to whether actual mining methods or a dissolution technique will be used to recover the potash.

ITALY

★**Italian production** of ores and metals is still running below prewar levels. The mining industry in general now employs about 68,000 workers, of whom 10,400 work in lead-zinc mines, 15,800 in pyrite and sulphur mines, and 4,900 more in smelting antimony, lead, and zinc. Trend of production in 1949 was down, and has turned up only slightly in 1950. Total value of mineral output in 1949 was $76,000,000, of which about $18,000,000 was exported. Mineral exports for the first half of 1950 total $12,000,000. The following figures have been released by the Italian Mining Association:

Italian Mineral Production

metric tons

Ores	1948	1949	6 Mo.-1950
Bauxite	153,147	104,852	76,953
Lead	47,381	57,642	31,174
Zinc	125,786	123,928	62,952
Coal	561,713	1,014,086	501,200
Pyrite	835,027	866,179	464,548
Sulphur	173,644	188,544	105,175
Asbestos	13,044	15,877	9,850
Talc	70,135	60,210	33,200
Metals			
Aluminum	33,083	25,647	16,540
Lead	26,171	27,316	19,388
Zinc	26,757	26,657	17,278
Mercury (flasks)		44,200	25,400

★**Monte Amiato,** leading mercury producer, is planning to mechanize its mining methods all the way to the distilling furnaces, and to erect more distilling capacity. **Monteponi,** lead-zinc producer, plans to double its flotation capacity, and has already installed a new roaster. **The SAPEZ company** has begun building a new electrolytic zinc plant with a capacity of 10,000 tons of zinc yearly.

★**The Italian Government participates** in mining to the following extent: 5% ownership in mercury mining, 95% in iron ores, 97% in coal and 20% in lead and zinc. Strangely enough, the 98% Government holding of asbestos production was recently made over to the Enit Co., a group connected with the British Turner organization. This transaction has aroused much argument in the Italian Parliament, inasmuch as the San Vittore Quarries, involved in the deal, were unlike most other State-controlled operations, quite profitable.

BELGIUM

★**Societe Metallurgique de Hoboken.** Belgium's most important refiner of non-ferrous metals, reported that in the year ending June 30, 1950, net profits amounted to 94,120,000 Belgian francs, against 72,900,000 in the previous year. Net dividend was 250 francs, against 200 previously. All radium that the market would absorb

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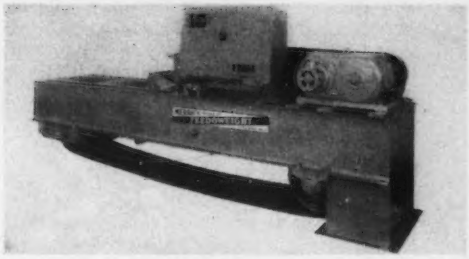

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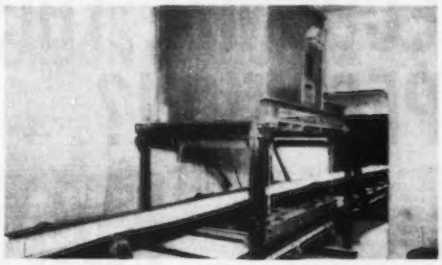

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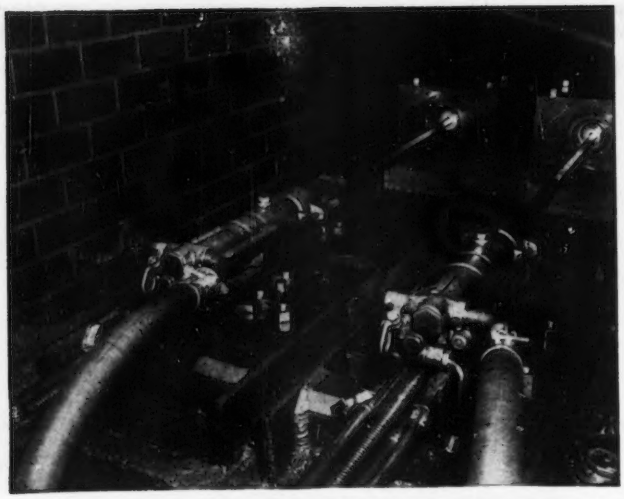

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Europe *(Continued)*

had been sold; cobalt production continued at a normal rate. The electrolytic copper refinery was extremely busy, both on Union Minere copper and foreign metal.

SWEDEN

★**Government mining investment** of 8-million kronor in the Rudtjebäck mine, N. Sweden, is recommended by the Swedish Board of Trade. Discovered ten years ago, the orebody runs to 3.3 million metric tons, of which some 90% is worth extracting for a calculated yield of 21,000 tons of copper, 86,000 tons of zinc, and 960,000 tons of sulphur.

Rudtjebäck lies in the Adak field, all of which is government owned. The neighboring Adak mine is operated for the government by the **Boliden** company. As only this company has the plant necessary for processing the complex ores, presumably it will operate the new mine as well.

The Rudtjebäck ore contains 49.1% sulphur, 1% copper, and 4.25% zinc, average content. A part of the orebody, however (850,000 tons) averages 2-3% copper which is about what the Adak workings now yield. The Board of Trade recommendation follows successful trial beneficiation of the ore by Boliden. The 8 million kronor should cover the first two years' development.

★**First new Boliden mine to get** working will be at Renström, 12 miles from Boliden village. The Boliden-type ore contains sulphur, copper, zinc and lead, with some silver and gold. Problems involved in beneficiation of the exceptionally fine-grained ore have finally been solved, and construction of a new concentration plant begun at Boliden. Designed with an initial capacity of 250,000 tons of ore annually, this new plant will eventually replace the present one at the company's smelter at Rönnskär.

The new concentration plant is expected to be in operation by the winter of 1953-54. The Boliden mine itself will be worked out in about 15 years. Ore extraction has already dropped from around 400,000 tons (1942) to 170,000. But besides Renström, prospecting shafts have been sunk at several places near Boliden, which thus provides a convenient central location for the new plant.

★**New lead deposits** at Bellvik and Löfstrand, near Dorotea in N. Sweden, are being analyzed by the Boliden company. The company has paid four local farmers 320,000 kronor for the mining rights, plus a royalty on the ore mined. As soon as the ground freezes, 400 tons of ore will be shipped to Rönnskär. The orebody here is more dispersed than at the company's Laisvall mine, near the Norwegian border, where ore with a 6% Pb content is obtained and shipped as an 80% concentrate.

★**Titanium and vanadium,** alongside iron, may be mined on Ulvön, near Örnsköldsvik, if the prospecting shaft the **Höganäs company** proposes sinking on the island reveals suitable deposits. Primarily a producer of refractories, the company has successfully operated a sponge iron plant for the last 30 years,—and it is an important source of iron powder.

★**Pelletizing plants** are being constructed by two leading producers of specialty steels in Sweden,— **Sandviken and Bofors.** Bofors, belonging to the Swedish SKF company, is probably the world's biggest producer of special steels, supplying other markets besides the SKF companies around the world. Its pelletizing plant will have a daily capacity of 30 tons. Sandviken's, with 100 tons daily capacity, will use fine powdered concentrates from the company's Bodas mine. Containing a high percentage of sulphur, the concentrate does not sinter too well. One use of the pellets will be in the company's new sponge iron furnace, which starts operation next winter.

★**Purchase** of an iron mine from **Mertainens Gruv AB** is advocated by the board of the Government owned steelworks at Lulea, Norrbottens Jernverks AB. Unless they have a mine of their own, say the board, the ore problem cannot be properly solved. At present the steelworks buys ore from Luossavaara-Kiirunavaara (half Government owned) at cost plus 10%.

The Mertainen mine would be paid in 5-million kronor worth of Norrbotten shares.

★**New ore-loading wharf at Narvik,** with an average capacity of 1,400 tons an hour, is now in use. Loading speed is not much greater than that of the old wharf, but much labor is saved—and larger vessels can load. Construction was done by Norwegians, while the mechanical equipment came from Nordströms Linbanor, the Swedish company which built Boliden's famous 60-mile aerial tramway.

★**Ore shipments to Germany** from Narvik were running at 300,000 tons a month last summer. Germans were using their own tonnage to fetch the ore, too; they had four ships all told. Recently, all ore shipments were threatened with cancellation, in reprisal for Germany's refusal to ship coke to Sweden. Of total German ore imports in 1951—6-million tons—4.5-million tons were to come from Sweden. This quantity was to have been divided as follows: 3.6-million tons high-phosphorus ore from Lapland, 500,000 tons relatively phosphorus-free ore from central Sweden, 300,000 tons of limonite ore. Far more coke can be saved in German blast furnaces by using high-grade Swedish ore than Sweden could ever need—so there is little danger of Swedes not getting their coke.

NORWAY

★A government loan of 500,000 kroner for developing lead and zinc mines at Korgen, N. Norway, has been granted **A/S Bleikvassli Gruber.** Production of zinc in Norway has dropped from around 15,000 tons prewar to 10,000 tons (50% concentrates). Electrolytic zinc output from **Det Norske Zinkkompani A/S,** Odda, runs to 45,000 tons at full capacity, using largely imported concentrates. Increased output from the existing Norwegian mines is not feasible. Korgen deposits, on the other hand, are large.

★Swedish interest in a Norwegian ore field is indicated by **Nordiska Gruv's AB** sending an expert to examine deposits at Gietvannet, in the mountains near Russenes on Porsangerfjord. Ore contains nearly 20% Pb, besides copper, zinc, sulphur, silver and gold. The extent of the field is not yet known, but Norwegian government geologists will try to ascertain it next summer. Nordiska Gruv AB does not operate any mines, but owns some fields, including a copper deposit at Repperfjord in Norway. It is connected with Ställbergs Grufve AB.

★**Uranium mining at Arendal, S. Norway,** will produce 3 tons of uranium in the next three years, according to estimates by Evje Gruber. This company is the only producer at present, although uranium is found elsewhere in the country.

★A. P. Flockart, chairman of Maude

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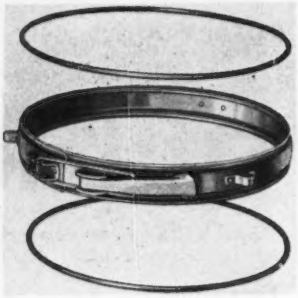

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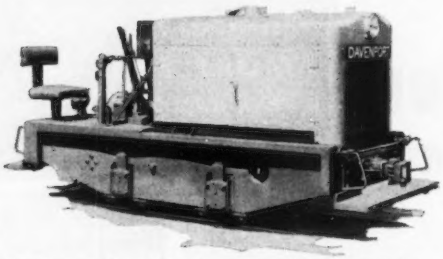

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Europe *(Continued)*

and Yellow Girl Gold Mining, N. L., said in his annual report to stockholders that gold remained the cheapest commodity that could be purchased with paper money. Apart from the hope that the price would rise in terms of the U. S. dollar, the only way to earn satisfactory profits was to step up through-put, and this required more men. The company was faced with the alternative of trying to undertake an expensive housing program in the hope of attracting more men, or of carrying on with the present labor force until the future became clearer.

★**Harrietville (Tronoh) Ltd.** incurred a loss of £14,044 in the year ended June 30, compared with a profit of £13,298 in 1948-49. The dredge treated 1,413,500 cu. yd. of virgin ground and 1,083,000 cu. yd. of tailings for a return of 5,926 oz. of gold.

★**Central Deborah Gold Mining Co., N. L.,** reported a loss of £8,134 for the six months ended Sept. 30. Crushing from stoping and development yielded 604 oz.

IN THE PHILIPPINES

★**Surigao Consolidated** milled 9,260 tons in November, from which 2,248 oz. of gold were recovered, as well as lead concentrates containing 980 oz. of gold, 1,400 oz. of silver, and 123,000 lb. of lead. During the month the recently discovered high grade orebody on the 500 ft. level was blocked out. The orebody which is almost entirely massive sulphides averages better than 0.5 oz. gold per ton and covers an area on this level approximately 50 ft. wide and 100 ft. long. Diamond drilling in the zone between the 500 and 600 ft. levels indicates the high grade orebodies continue to the 600 ft. and appear to consolidate in a more confined area. Two new sinking pumps were installed.

★Recent results of development work at **Mindanao Mother Lode** are extremely encouraging. On the 1,000-ft. level the Tabon vein has been opened up for 1,100 ft. averaging 0.83 oz. across 35 in. The new interior shaft sunk on the middle of the high-grade section was 1,063 ft. deep on Nov. 29.

★**Lepanto Consolidated** shipped 10,000 tons of concentrates late in November to the Tacoma smelter, valued at over P3,000,000. The company declared a 10% dividend in October and followed it with a 20% dividend in December after having declared a 66⅔% stock dividend as well.

★Shipments of chromite to the United States from the **Consolidated Mines** in Zambales were stepped up in November to 29,000 tons, a monthly record for 1950. Given the ocean freighters, this rate of shipments can be maintained indefinitely from the mine.

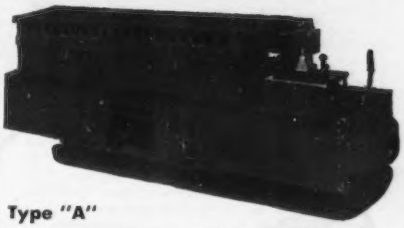
★Since the start of rehabilitation work in February, 1950, more than 15,000 ft. of mine workings have been reopened at the **Itogon mine** controlled by Marrsman & Co. in the Bagiuo area. The more important work included opening of the Frog tunnel to renew ventilation along the Itoe vein, realinement of the main Taka three-compartment shaft to the 500-ft. level and repair of the steel headframe and main hoist. The shaft is now in operation to the 500-ft. level. Reopening of the 875 drain tunnel will clear the mine workings of water by the end of the year. The power plant has been rebuilt and three 500 hp. diesel generator units have been installed. Plans have been drawn for a 300-ton mill and orders for equipment have been placed. War damage payments totalling $1,215,000 have been received, but additional funds will be required to rehabilitate the property. A loan application for $500,000 has been made to the Reconstruction Finance Corporation.

★At the **United Paracale** mine in the Paracale district a new cross cut has been driven to gain entry to the McDonald vein above waterlevel. Production will begin as soon as this section is prepared for mining. The caved section of the main Longos shaft has been reopened and a new headframe is under construction. Special pumping equipment has been ordered from the United States for handling the heavy water flow in the Longos area, estimated at 4,000 gpm. against a 500-ft. head. Other orders have been placed for mine and mill equipment designed to place the property on a production basis of 7,500 tons per month by the time the new concentrate retreatment plant at San Mauricio is completed.

★A difficult job was accomplished at the **San Mauricio** mine also in the Paracale area, in reopening the Reed drain tunnel for 1,400 ft. through badly caved ground to connect with No. 2 shaft. The main three-compartment shaft has been completely retimbered to the water level. The steel headframe has been repaired and the power plant rebuilt, making 1,300 hp. available. Unwatering the mine will be started in January.

★At the **Coco Grove** property, the dredge Mary Angus is now afloat and repairs to the hull, ladder, and stocker are underway. The machine shop has been rebuilt and new 6,600 and 2,300-v. power lines have connected with the United Paracale power plant. Under the present program all work should be completed and the dredge should be ready for operation by May, 1951.

ATLAS LOCOMOTIVES HAVE THAT EXTRA



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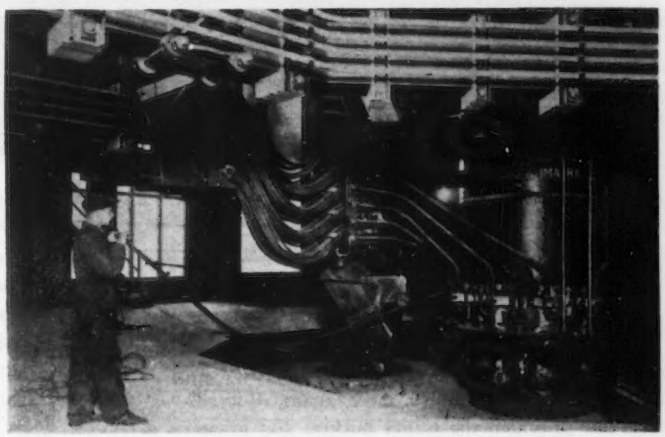

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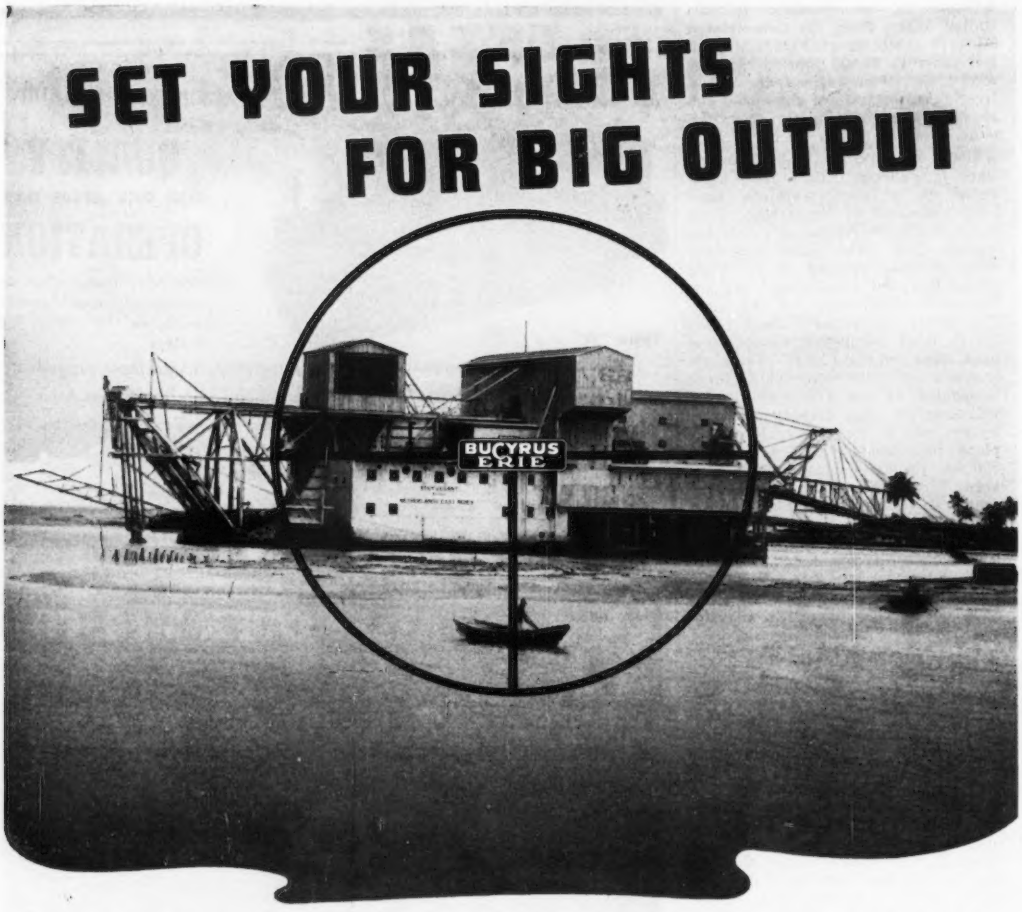
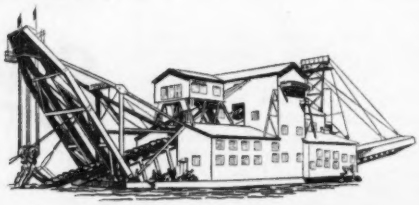


THE trend in placer mining has been towards large dredges for profitable operation on extensive but relatively low-grade properties.

In building dredges of ever increasing output to meet the demands of working these placers, Bucyrus-Erie's "years ahead" engineering is in the forefront as it has been in developing a long list of previous innovations. Here again, Bucyrus-Erie has provided the larger buckets and greater bucket chain speeds which have consistently turned up ever bigger yardages from placer deposits.

Bucyrus-Erie Company — builder of successful dredges for 65 years — has produced machinery, too, within the superstructure to handle the larger inflo and secure the nearest possible approach to 100% recovery of ores. Screening and washing plants on Bucyrus-Erie dredges are built to keep pace with the speed of the buckets.

The Bucyrus-Erie name plate on your placer dredge is not only your best assurance of big output; it is your best assurance of long-term big output. These steady-working machines will turn up underwater profits for you shift after shift for many years to come.



29050

BUCYRUS-ERIE COMPANY · SOUTH MILWAUKEE, WISCONSIN

In Metallurgy, Accent Is on New Metals, New Methods

(*Continued from page 125*)

plant during World War II, using an ammonia leaching process.

Robert C. Stanley, chairman of Inco, has announced that the Orford process has been discarded as of last July by his company in favor of the matte flotation process for the separation of nickel and copper. Some of the details of this new process were mentioned in previous reviews. An oxygen plant and an initial flash smelting furnace are under construction at Copper Cliff.

Inco is also interested in producing iron as a by-product of their copper-nickel operations. No details have been released, but such efforts could take two directions. The flotation tailings could be treated to make a pyrite concentrate which could then be sintered for sulphur elimination. A second possibility would be the treatment of reverberatory slag to recover the iron content. This latter method has been thoroughly investigated by Outokumpu Oy and is the subject of U. S. Patent No. 2,523,092 issued to Bryk and Ryselin. The liquid slag is charged to a three-phase arc furnace and a mixture of lime and carbon is dropped into the zone between the electrodes. According to the patent, the intense heat of the arc forms calcium carbide, which in turn reduces the iron from the iron silicate slag and is much more effective as a reducing agent than solid carbon. The final products will be molten iron and a calcium silicate slag. The slag has value as a fertilizer for acid soils.

A new cobalt refinery is to be built in Garfield, Utah, by the Howe Sound Co. at a cost of over $1 million to treat the concentrates from the Blackbird Mine in Idaho.

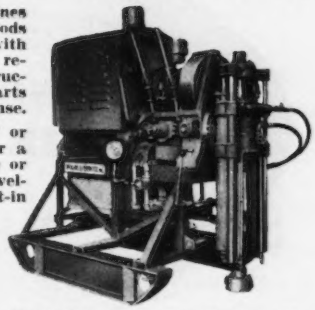
Aluminum

Aluminum production has been substantially increased by the completion of Alcoa's new 57,000-ton plant at Point Comfort, Texas. This plant is unique in that the source of electrical power is a large installation of internal combustion engines burning natural gas. The 1,600 hp. engines built by Nordberg resemble radia aircraft engines; they have 11 cylinders and operate on 2 cycles at 360 rpm. Each engine-generator combination delivers 1,000 kw. at 667 volts to the 3 pot lines, each line having 120 cells.

60 YEARS of Successful Experience in DIAMOND CORE DRILLING

enables us to manufacture drilling machines that can be relied upon for long periods of continuous high-speed operation, with greatest possible percentage of core recovery. Modern designs, rugged construction, and liberal use of alloy-steel parts minimize time losses and operating expense.

Swivelheads can be either "Screwfeed" or "Hydraulic." Power-unit can be either a gasoline or Diesel engine, an air engine or an electric motor—each driving the swivelhead and hoisting drum through a built-in four-speed sliding-gear transmission. A complete line of improved accessory equipment provides for every drilling and sampling requirement. Catalog mailed promptly on request.



Model 40-C Core Drilling Machine, with Gasoline Engine Power Unit and Oil Operated Hydraulic Swivelhead.

CONTRACT DRILLING

Besides being manufacturers, we are also one of the largest contractors for any type of Core Drilling—including Grout Holes and Grouting. Experienced crews and supervisors are available at all times for service anywhere in the world. Estimates, and constructive suggestions whenever possible, submitted promptly without charge.

"TRUCAST" BORTZ DIAMOND BITS

have proved their superiority for years in all types of rock formation. Bits may be furnished with various grades of bortz diamonds, set in a matrix of either Beryllium Copper or Beryllium Nickel alloys. Available in a wide range of standard and special sizes ranging from 1½" to 7¾" in diameter.

SPRAGUE & HENWOOD, Inc. Dept. M M Scranton 2, Penna.

See our four-page insert in the Mining Catalogs

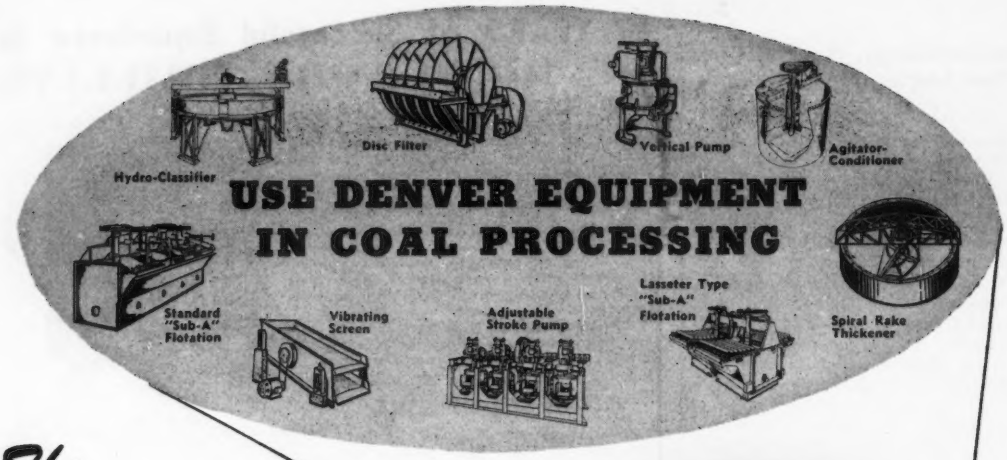
LOOK AT THE BOX SCORE!

See Why the Swing is to *Life-Sealed* BALL BEARING IDLERS

	CONVENTIONAL TAPERED ROLLER BEARING IDLERS	LIPPMANN LIFE-SEALED BALL BEARING IDLER
BEARINGS	Tapered roller	Ball, like the rear axle on your car, takes thrust as well as radial load, absorbs punishment without service.
SHAFT	Through	Stub—saves cost, saves weight, requires less precise alignment.
LUBRICATION	Once a week with grease gun from one end—if grease congeals, bearing opposite fitting receives no grease.	Each bearing permanently lubricated and sealed. First LIFE-SEALED Idlers sold have been in continuous service for 7 years without added lubrication or replacement.
COST/IDLER (typical size)	$27.00	$24.00 — 15% less
COST/1000 FT. (4 ft. spacing)	$6750.00	$5750 — $1000 saved
WEIGHT/IDLER (same size)	58 lbs.	39 lbs. — 30% less
WEIGHT/1000 FT. (4 ft. spacing)	14,500 lbs.	9750 lbs. — 4750 lbs. saved
INSTALLATION	Careful adjustment for running clearance with fine thread and castellated nut.	Brackets need not be precisely aligned—stub shaft has flexibility of a knuckle joint.
MAINTENANCE	Once-a-week greasing, periodic adjustment for wear. Must provide catwalk to grease and align Idlers. Replacements cost more.	Lippmann builds conveyors without a catwalk (a saving of $5.00 per foot) because they need no lubrication, no adjustment for wear or distortion. 2004

LEW LIPPMANN ENGINEERING WORKS
4603 West Mitchell St., Milwaukee 14, Wisconsin

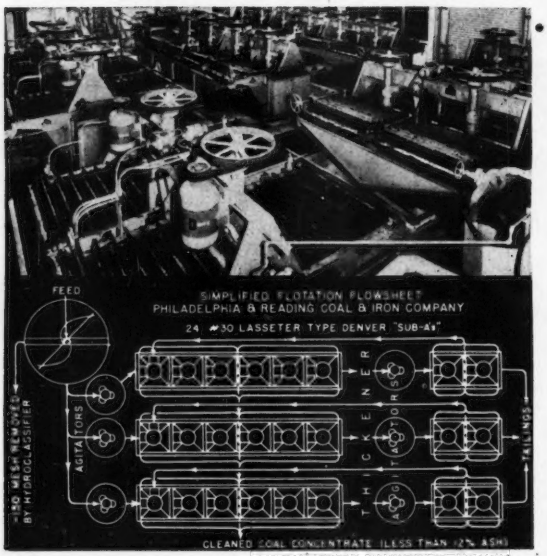
Ask for Idler Book 1410, Belt Conveyor Book 1400



The

PHILADELPHIA & READING COAL & IRON CO. *Uses*

DENVER "SUB-A" (Lasseter Type) FLOTATION



...TO RECOVER ANTHRACITE COAL FINES... LOW ASH CONCENTRATE AT LOW COST

Products: Anthracite Coal Fines.

Particle Size: Minus 10 mesh to plus 200 mesh.

Tonnage: 150 TPH initial feed.

Flotation Cells: 24 No. 30 (Lasseter type) Denver "Sub-A" Cells.

Flotation Feed: Ninety tons per hour (minus 150 mesh removed from original feed).

Flotation Concentrate: Sixty tons per hour. (One ton per minute.)

Ash Content: Less than 12 per cent.

Reagent Cost: Less than 15 cents per ton feed.

Hear this Story AT A. I. M. E.

Read this Story IN DECO TREFOIL

This complete story will be told at the February 1951 A.I.M.E. meeting in St. Louis by Mr. H. R. Hagen of the Philadelphia and Reading Coal and Iron Company . . . and will be printed with details and pictures soon in Deco Trefoil.

Reserve your advance free copy now! Write today.

FLOTATION ENGINEERS

DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

"The firm that makes its friends happier, healthier and wealthier"

DENVER • NEW YORK • CHICAGO • EL PASO • VANCOUVER • TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG

DENVER EQUIPMENT COMPANY, 1402 17th St., Denver 17, Colorado

Whether you want one worm-gear speed reducer or a thousand, a standard drive or a unit designed to meet special problems, Cleveland can serve you better.

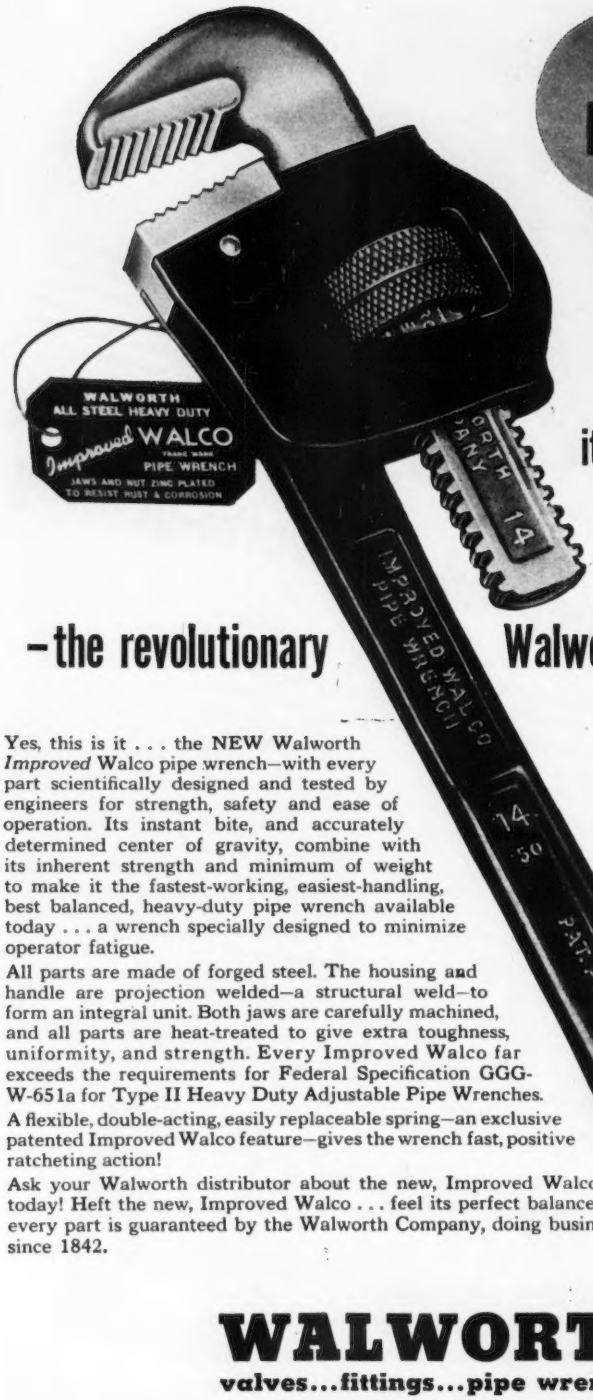
Prompt service on dependable worm-gearing

• For dependable worm-gearing, consult Cleveland—a company which for 38 years has devoted its engineering skill and production facilities exclusively to the manufacture of high grade, precision-built worms and gears. Cleveland offers a complete line of worm gear sets and speed reducers, including the popular fan-cooled Speedaire—to meet the requirements of any machinery or equipment builder or user for this convenient, right-angle drive.

Our sales representatives, located in major industrial market centers, are ready to sit down with you and discuss your power transmission needs, to help you select correct types and sizes. Our service is prompt. Write for our latest catalog and give us an idea of your requirements. Your inquiry will receive our careful attention.

The Cleveland Worm & Gear Company, 3281 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.



it's New!

it's Different!

it's the strongest pipe wrench in the world!

–the revolutionary Walworth improved Walco®

Yes, this is it . . . the NEW Walworth *Improved* Walco pipe wrench—with every part scientifically designed and tested by engineers for strength, safety and ease of operation. Its instant bite, and accurately determined center of gravity, combine with its inherent strength and minimum of weight to make it the fastest-working, easiest-handling, best balanced, heavy-duty pipe wrench available today . . . a wrench specially designed to minimize operator fatigue.

All parts are made of forged steel. The housing and handle are projection welded—a structural weld—to form an integral unit. Both jaws are carefully machined, and all parts are heat-treated to give extra toughness, uniformity, and strength. Every Improved Walco far exceeds the requirements for Federal Specification GGG-W-651a for Type II Heavy Duty Adjustable Pipe Wrenches.

A flexible, double-acting, easily replaceable spring—an exclusive patented Improved Walco feature—gives the wrench fast, positive ratcheting action!

Ask your Walworth distributor about the new, Improved Walco today! Heft the new, Improved Walco . . . feel its perfect balance—every part is guaranteed by the Walworth Company, doing business since 1842.

Check these outstanding features

LIGHTER: Housing and Handle are projection welded to form one integral unit.

CORRECT BALANCE: Accurate, the correct location of the center of gravity determined by test.

STRONGER: Heat treated to eliminate brittleness . . . cracking.

FAST ACTING: Scientifically designed spring action insures positive ratcheting action . . . quick bite.

CALIBRATED PIPE SCALE: Built-in scale permits speedy adjustment to pipe size.

RENEWABLE PARTS: All parts are readily obtainable, and easily replaced without special tools; thus prolonging service life indefinitely.

RUST RESISTANT FINISH: Entire wrench is rust resistant—Nut and Jaws have a special electroplated zinc coating.

WALWORTH

valves...fittings...pipe wrenches

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

TAKES HEAVY IMPACT

LIKE A POOL TAKES A PEBBLE

Homocord CONVEYOR BELT

"We seldom see a cut or gouge in Homocord Conveyor Belts. And they consistently outlast other belts on heavy-duty installations."

There are engineering reasons for this typical user report. The extra body-cushion built into Homocord dissipates the shock of sharp impact from large lumps of coal, ore and rock . . . assures long life. Natural troughing and flexibility add up to more ton-miles of materials carried.

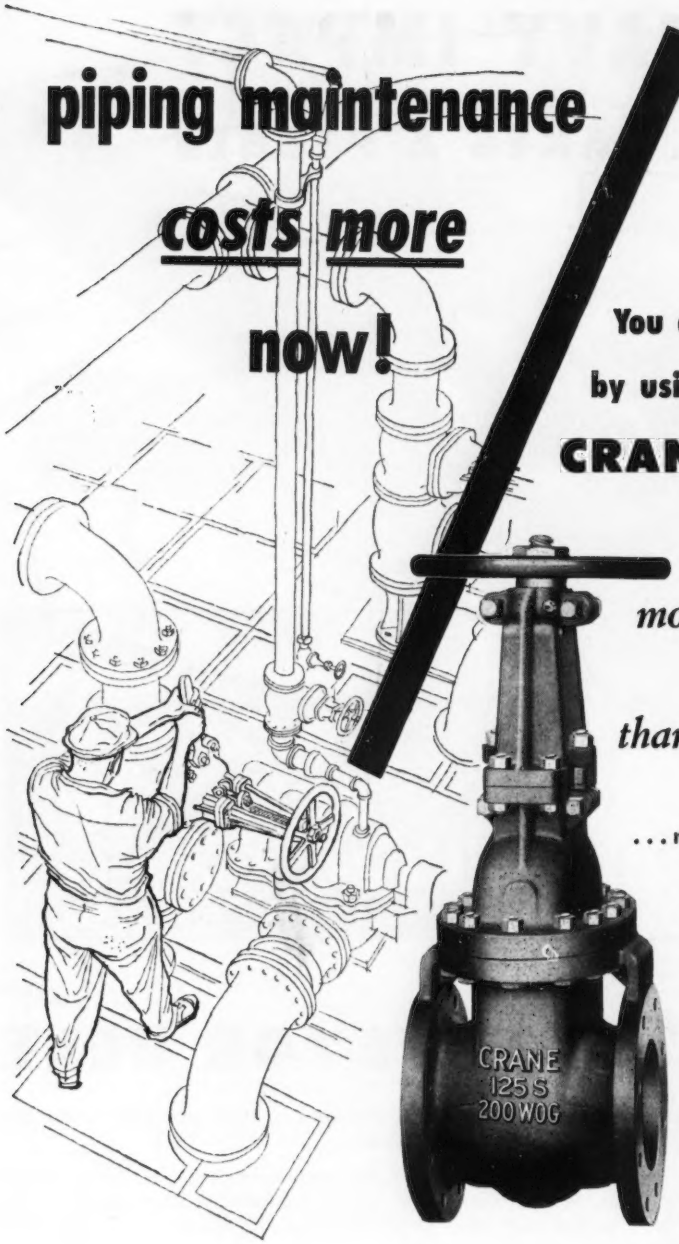
Full description of these and other advantages are described in Bulletin 6906. Let us send you a copy. You get the same long-life engineering in R/M hose, V-belts and flat belting. Ask your R/M representative.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive and Diamond Wheels • Bowling Balls

piping maintenance *costs more* now!



You do less of it

by using Dependable Quality

CRANE VALVES

That's why more Crane Valves are used than any other make

. . . no bonnet trouble with this valve

A typical example of low-maintenance Crane Quality—No. 465½ 125-Pound Iron Body Gates. Rarely does the bonnet joint need attention. Flange construction includes reinforcement to prevent distortion and utilizes more bolts, more closely spaced than is usual in valves of this class. Crane precision-guided seating reduces seat and disc wear. Packing has long life because these valves have a deep stuffing box filled with high grade asbestos ring packing. A ball-type gland equalizes the packing load.

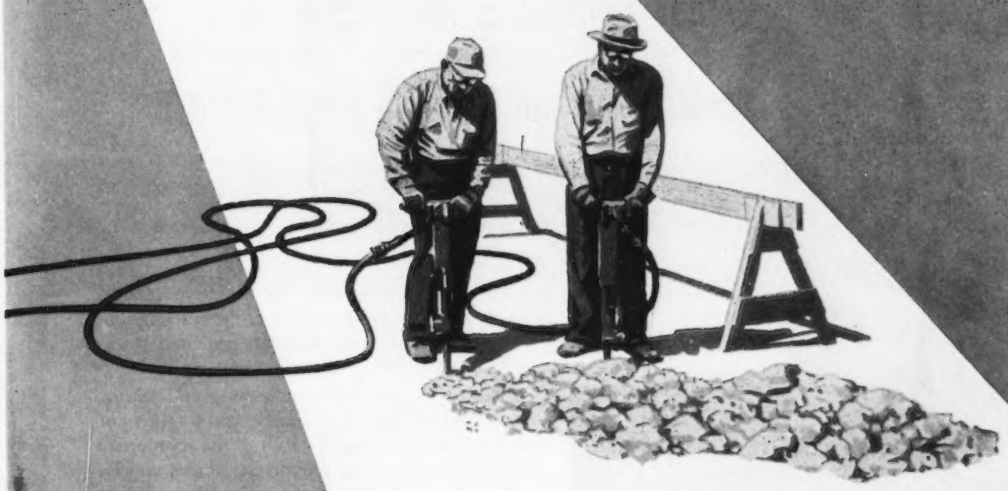
Better performance features like these make Crane the better buy in valves of every type. Ask your Crane Representative for a demonstration.

CRANE

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Thermoid
Industrial
Rubber Products
Quality
Value
Service



Hose built for the job! That's the reason for Thermoid's excellent reputation among users of hose.

Our customers know they can rely on Thermoid's recommendations for their requirements . . . whether it's for air, water, suction, sand and concrete discharge, dredging sleeves, jetting hose—or any of the many other types of Thermoid hose built for the mining and construction industries.

And men who buy these quality products like the service they get from Thermoid's experienced distributors and sales representatives—and their intimate knowledge of the *buyer's* problems.

Get the hose built for *your* job. Specify Thermoid.

Conveyor & Elevator Belting • Transmission Belting
F.H.P. & Multiple V-Belts • Wrapped & Molded Hose

Thermoid

Rubber Sheet Packings • Molded Products
Industrial Brake Linings and Friction Materials

Thermoid Company • Offices & Factories: Trenton, N. J., Nephi, Utah

ALL ROPES *look* ALIKE... but

IN Wickwire Rope

Carbon Content is Determined on Scales that can Weigh a FINGERPRINT

Scales so sensitive they can weigh your finger print—that's a typical example of the exacting control we maintain over steel that goes into Wickwire Rope.

Because of such precision analysis and testing, we're able to hold and maintain carbon content of steel within five points (.05%) of the appropriate value for each of our commercial grades of wire rope. That's mighty important—because correct carbon content of steel determines its strength, toughness, ductility, hardness and uniformity of grain size to McQuaid-Ehn* standards.

Basic control like this is possible only with a fully integrated company like Wickwire where manufacture of wire rope starts with the actual making and refining of the steel.

Thus, Wickwire goes "beyond specifications" to supply you with wire rope that has no equal for longer life, utmost safety and enduring reliability.

Look for the YELLOW TRIANGLE on the reel

*Write for detailed information on the McQuaid-Ehn test to Wire Rope Sales Office, Palmer, Mass.

WICKWIRE ROPE CF&I

A PRODUCT OF THE WICKWIRE SPENCER STEEL DIVISION OF THE COLORADO FUEL AND IRON CORPORATION

WIRE ROPE SALES OFFICE AND PLANT—Palmer, Mass. **EXECUTIVE OFFICE**—500 Fifth Avenue, New York 18, N. Y.

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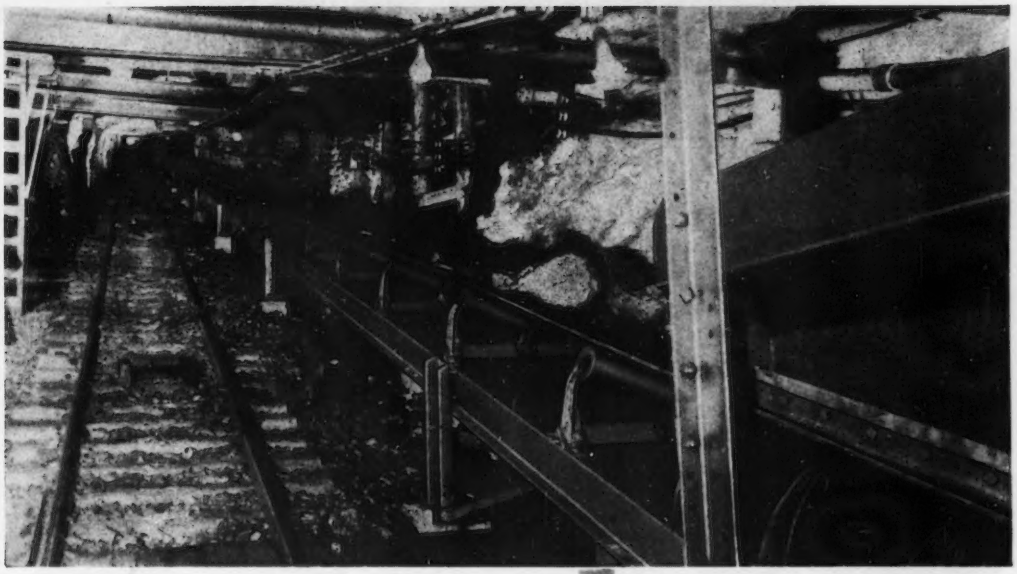
PACIFIC COAST SUBSIDIARY—The California Wire Cloth Corporation, Oakland 6, California

12,500,000 TONS HANDLED...



was just a start for Rex Idlers

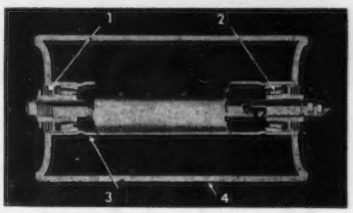
You'd think that carrying 12,500,000 tons of material would be a lifetime job for any belt conveyor idlers. After these rugged Rex Idlers handled that amount of aggregate for the Shasta Dam as a starter, the same idlers were installed on the longest, highest belt slope conveyor in regular service. And they're still going strong.

That's real proof that Rex Belt Conveyor Idlers give you lowest cost service . . . that they eliminate costly down time caused by premature idler failures. Not only do Rex Idlers last longer, they also are easy on the belt. They eliminate destructive belt pinching and creasing, and absorb practically no power. Special application idlers, such as Rex Impact Cushioning Idlers illustrated above (lower right hand corner), installed under loading points, protect belt from laceration and carcass failures.

For the complete story on these cost-cutting idlers, mail the coupon for your copy of Bulletin No. 463R.

REX CHAIN BELT COMPANY — BELT CONVEYOR IDLERS

These Rex Quality Features Add Life to Your Conveyors



1 Triple labyrinth grease seal . . . dust stays out, grease stays in.

2 Tapered roller bearings, deadshaft type mounting, oversize capacity.

3 Unit mounting for bearings for positive alignment and minimum friction.

4 Heavy duty one-piece welded steel construction for maximum roll life.

50-200

CHAIN BELT COMPANY
1679 West Bruce Street
Milwaukee 4, Wis.

Gentlemen:
☐ Send me my copy of Bulletin No. 463R.
☐ I would like to see a Rex Field Sales Engineer.

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Company.....*Dept*.....

Address.....

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The Great Mining Tire that does the "Impossible."

WHAT DO WE MEAN "IMPOSSIBLE"?

We mean that never before—and now for the first time—you've got a mining tire with **SUPER-TRACTION OFF THE ROAD** where you need it—with a **SMOOTH NON-SKID, LONG-WEARING ROLL ON THE HIGHWAY** when you want it.

WE ALSO MEAN you get tread compounds ***JOB-FITTED TO YOUR EXACT REQUIREMENTS,*** compounds that stand up under the toughest conditions that ever faced a tire. ***THE ONLY SUCH TIRE IN THE WORLD.***

★ ***70% Deeper Traction Tread*** — this feature alone is good for up to ***50% MORE ACTUAL MILES.***

★ ***Entirely New Inner-Cavity Form*** to cut carcass strain—actually built and round-moulded to the tire's inflated shape—for today's wide-base rims. Reduces shoulder and tread stress and strain. This is how Fleetmaster can build its **EXTRA TREAD DEPTH** and **THICKER UNDER-TREAD.**

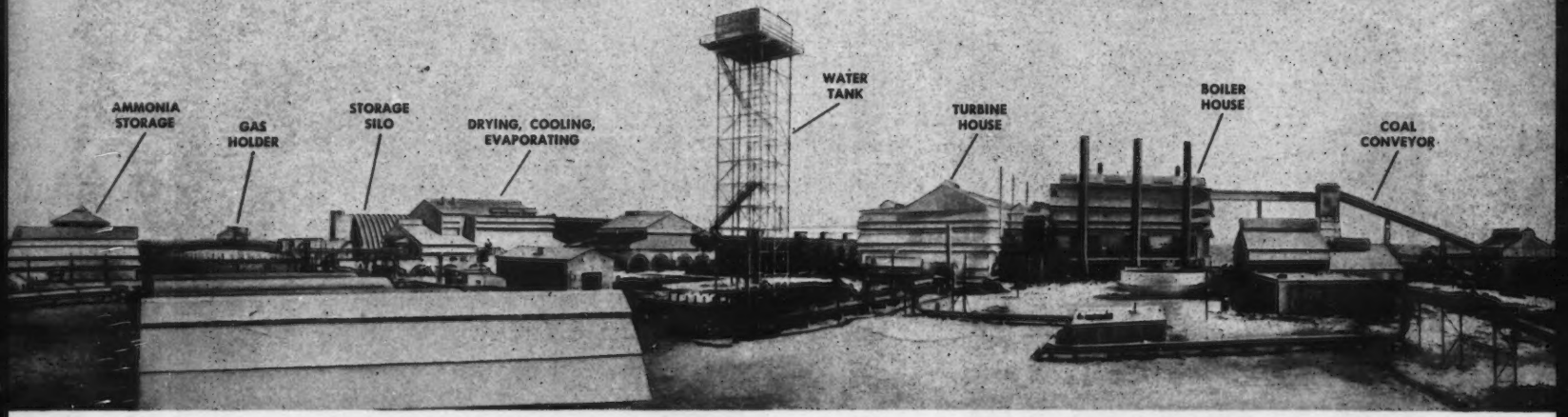
★ ***More Rubber Contacts the Road*** as mileage increases. Result? Longer wear—more miles.

Get Our Complete Proof Demonstration Today! A Phone Call Does It—To Your Nearest U. S. Royal Dealer!

UNITED STATES RUBBER COMPANY

Fertilizer for India

ANOTHER IMPORTANT CHEMICO PROJECT WELL UNDER WAY



Helping modern India to meet its vast requirements for fertilizer is another one of Chemico's world-wide activities. This large ammonium sulfate plant, located at Sindri, in Bihar province, will soon be in partial operation. The project, when completed, will produce 350,000 long tons of nitrogenous fertilizer per year . . . with a daily capacity of 1000 tons. • The plant will utilize such raw materials as coal, coke and gypsum which are wholly indigenous to India. It will include a completely independent power and water supply of record proportions. • The Sindri works was designed and is being supervised by Chemical Construction Corporation, New York and is being erected by Power-Gas Corporation Ltd., England, for the Ministry of Industry and Supply, Government of India.

CHEMICAL CONSTRUCTION CORPORATION

A UNIT OF AMERICAN CYANAMID COMPANY

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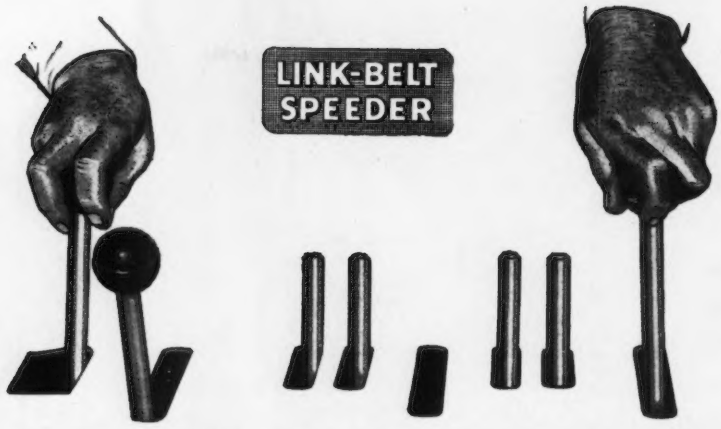
EUROPEAN TECHNICAL REPRESENTATIVE: CYANAMID PRODUCTS, LTD., LONDON W. C. 2, ENGLAND

CABLES: CHEMICONST, NEW YORK

Chemico plants are profitable investments

CC-818



At your fingertips... up to 25% increased output with

SMOOTHER, EFFORTLESS, *Speed-o-Matic* CONTROLS

Fingers instead of muscles do the work with Link-Belt Speeder's exclusive Speed-o-Matic* controls! Every move of Shovel-Crane is faster, more accurate, easier. You get "pin point" placement of bucket, shovel or hoe. No drag or lag, no jerk or jump. You "feel the load" every inch of the way—smoothly, surely, safely.

As for your operator, what a difference this control makes! He's fresh and fit, even during long overtime. And he lifts, loads and swings with a tireless precision that pays off in greater output, more profits for you.

Only Link-Belt Speeders offer you the unequalled advantages of Speed-o-Matic *full* hydraulic controls. Before buying any Shovel-Crane, be sure to see a demonstration. Phone or write your Link-Belt Speeder distributor.

*Available on 51, 300 and 500 Series.

Mining men the world over agree—Link-Belt Speeders with full hydraulic Speed-o-Matic controls add yards of production every day. Left: K-360 Link-Belt Speeder dragline stripping overburden. Right: Link-Belt Speeder K-370 shovel in loading operation.

12,237

LINK-BELT SPEEDER
CORPORATION

Builders of the most complete line of shovels, cranes and draglines
CEDAR RAPIDS, IOWA

BY THE YARD..

OR BY THE TON..

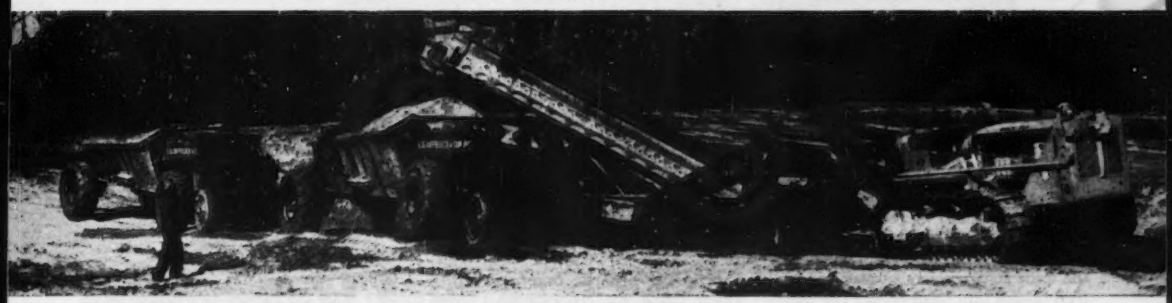
"EUCS"

Haul More Loads at Less Cost!

Leading contractors and industrial users buy Euclids because they are job proved for high production at the lowest cost per ton or yard moved . . . and because "Eucs" are designed and built throughout for long, efficient service in open pit mines and quarries, heavy construction and industrial work.

There is a Euclid model to meet every requirement in off-the-highway work . . . and body designs for all types of materials. Their rugged strength and stamina have made "Eucs" the standard hauling equipment of many leading operators. The Euclid Loader is built to match the speed and efficiency of other Euclid earth moving equipment. It is designed for use with the Euclid Bottom-Dump and other large capacity hauling units, and provides fast, mobile loading of practically any material.

Euclid's world-wide distributor organization assures fast, efficient service to all owners. Write for complete information on the Euclid models best suited to your job requirements and plan now to move more loads per hour at more profit per load with "Eucs" on your future off-the-highway work.



The EUCLID ROAD MACHINERY Co., CLEVELAND 17, OHIO

B.F.Goodrich

How BFG tires turned coal's top inch from dust to clean profit!

STRIP miners know that cleaning the coal seam after the stripping shovel has finished its job is often a dirty and wasteful operation. Before small shovels can begin removing the coal, the common practice has been to doze away the dirt left by the big shovel with crawler-type tractors. But the steel tracks of such equipment chew up the top inch of coal. This coal, in turn, blows about — leaving a black badge on men, machinery and equipment that represents lost profit.

Here's how the collieries operating the mine shown above turned this top inch of coal into clean profit. The light tractor, equipped with B. F. Goodrich Tractor-Grader Lug Type tires, replaced the heavy dozer. Because these tires have a tread especially designed to give super traction even when working under light equipment, the job was done faster and cleaner . . . without the waste of the top inch of coal. In addition, the superintendent reports that this fast-moving unit makes it possible to work right up next to the huge shovel bucket — saving time, and that means profit.

This is a small, but interesting example of how B. F. Goodrich gives greater service to operators of off-the-road equipment. BFG offers a special tread design for every job to be done. Only BFG has the patented *nylon shock shield*, the exclusive plus factor that practically eliminates bruise breaks that result in time loss and costly replacement. A layer of nylon cord is built in between the tread and body plies to shield the cord body. In tires for heavier service, there is a *double nylon shock shield* to smoothly distribute impacts and strains.

Next time you buy tires, see your B. F. Goodrich dealer. Specify B. F. Goodrich tires for your new equipment and enjoy the profits of longer service and greater traction. *The B.F.Goodrich Company, Akron, Ohio.*

RESEARCH KEEPS
B.F.Goodrich
FIRST IN RUBBER

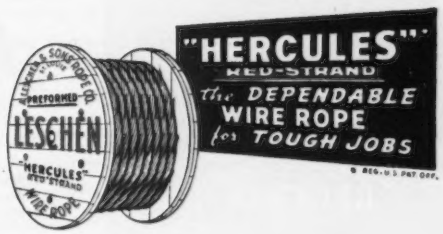
There Is More To Wire Rope Than Meets The Eye—

it's the invisible "ingredients" that make the difference.

Other than its one Red-Strand, a "HERCULES" Wire Rope would look pretty much like any other rope having no distinguishing mark. But there is a difference! And that difference is due to a "thousand and one" *invisible* factors. It is made possible by setting up and rigidly maintaining exacting standards . . . by utilizing our almost 100 years of manufacturing experience in the designing and fabrication of wire rope . . . by strictly following the principle of "quality first!"

As it has never been possible to actually see the numerous properties that make one wire rope outlast another, we originated—in 1886—the idea of painting one strand of "HERCULES" Wire Rope red, and since that time the Red-Strand has not only been a mark by which this rope could be identified, it has been our constant guarantee that its high quality is ever maintained.

Yes, there is more to "HERCULES" Wire Rope than meets the eye, but you can accept, with confidence, the assurance that the Red-Strand provides.



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— and only Beckman —

provides such wide range versatility in Glass pH Electrodes . . .

The importance of modern pH equipment is widely recognized in many fields . . . from food processing to sewage treatment—mining and smelting to electroplating—textile manufacturing to sugar refining. But when considering pH equipment for *your* problems always remember this . . .

"No pH meter is better than electrodes designed for use with it!"

Only Beckman provides such a wide variety of versatile, accurate and dependable electrodes—a type to meet virtually *every* industrial, research, laboratory and medical requirement. This is your assurance that, in Beckman pH equipment, you have maximum adaptability to widely-varying pH applications.

FREE . . . a convenient 28-page catalog illustrating the complete line of Beckman electrodes and pH equipment is available from your authorized Beckman Instrument dealer. Or write direct!

Whatever your pH electrode requirement, contact Beckman.

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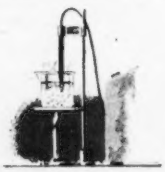
Beckman Instruments include: pH Meters and Electrodes—Spectrophotometers—Radioactivity Meters—Special Instruments

Typical Advantages of Beckman Electrodes

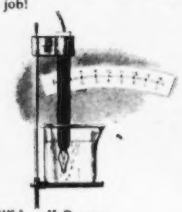
Virtually Unbreakable

Where abrasive slurries or rough industrial service are problems, Beckman has the answer with electrodes so strong, so tough, so chemically-resistant to alkalies and acids they set entirely new standards of durability!



Extreme Temperatures

Want to make measurements in solutions as cold as 20°C. *below* zero . . . or as hot as 130°C. *above*? Hot, cold or in-between, there's a Beckman pH Electrode to do the job!



Wide pH Range

Electrodes covering the full pH range permit accurate measurements even at extreme limits with negligible sodium ion error whether test solution is hot or cold!

Unique Construction

Beckman glass electrodes are factory-sealed, require no maintenance, feature patented internal shielding, heat-resistant construction, integral leads and many other advantages!

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Just Published!

1. A new book explaining the prospecting, mining, processing, and marketing of the various grades of Indian mica. Covers the geological considerations of mica deposits—tells what constitutes efficient mica mine management—gives numerous statistical data on many phases of the mica industry. The book includes information on the growing uses of mica in the electrical and electronic fields, etc. **By Chandmull Rajgarhia, Managing Director and Chief Mining Engineer, Indian Mica Supply Co. 376 pages, 86 illustrations, $8.00.**

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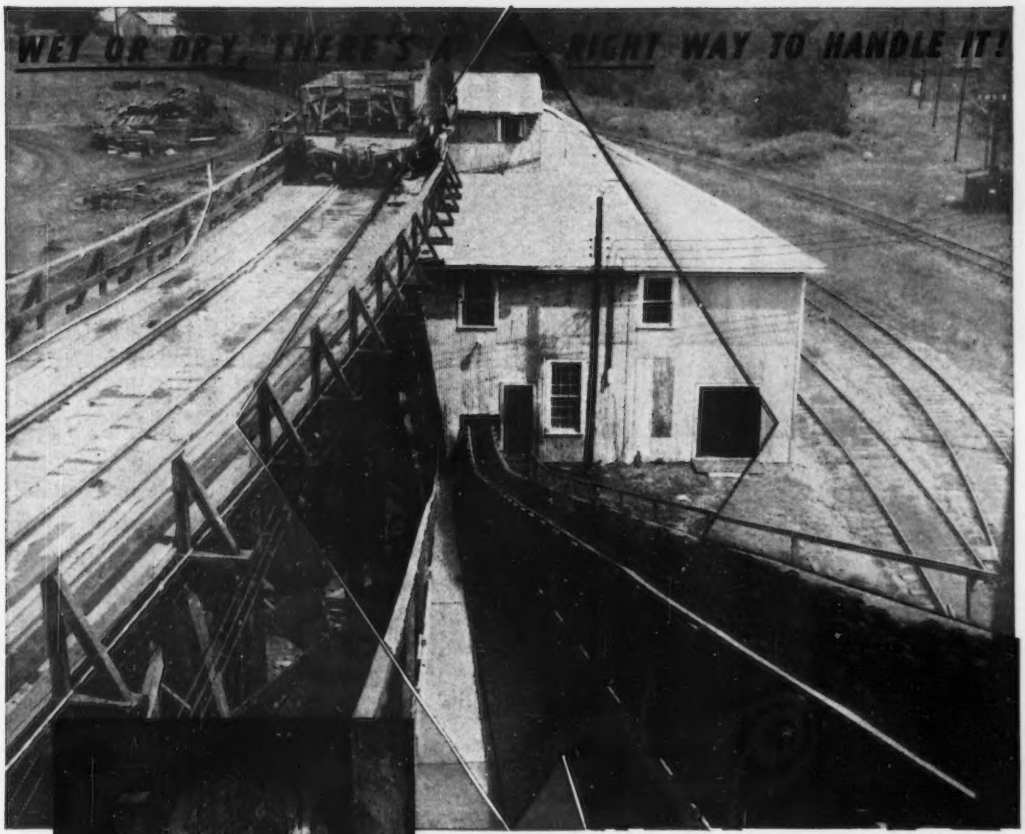
Barber-Greene



There's a common answer to the problem of moving bulk materials —everything from wet Feldspar to heavy iron ore—in the fastest, most economical way. B-G Belt Conveyors have proved this time and again in numerous underground and surface installations.

And unique among all belt conveyor manufacturers, Barber-Greene offers the benefits of Barber-Greene "pre-engineering." B-G Conveyors come to you as packaged units, clearly marked for simple assembly without extra fabrication and "blueprint" work. See your Barber-Greene distributor.

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Constant Flow Equipment

LOADERS PERMANENT CONVEYORS PORTABLE CONVEYORS COAL MACHINES BITUMINOUS PLANTS FINISHERS DITCHERS

FOR **FILTERING** FUMES, DUST, SMOKE... AND SOME LIQUIDS

a superior filter fabric-

FUMEALL*

TRADE-MARK

a combination of Virgin Wool and DYNEL...

The RIGHT filter cloth for your job is now available in Portland Woolen Mills' new, longer-lasting **FUMEALL** filter fabric. Now in use by leading smelters, **FUMEALL** marks the high spot in Portland Woolen Mills' 50th Anniversary Year.

COMPARE THESE FEATURES WITH YOUR PRESENT FILTER FABRIC:

How Long Does It Last?

In actual operational tests, **FUMEALL** lasts at least 3 times as long as conventional all-wool filter fabric; on accelerated tests, 6 times as long.

Does It Have the Right Porosity?

You get exactly what you want with **FUMEALL**: the RIGHT weave for the specific job required. At present, **FUMEALL** is available in 5 different weights—from the most porous 14-oz. to the least porous 24-oz. If you need a finer or coarser weave, you can have that, too. **FUMEALL** may be napped or unnapped to vary the length of run between clearings.

Does It Have Resistance to Moisture?

In intermittent filtering operations, **FUMEALL** moisture absorption is 50% less than conventional all-wool fabrics. This prevents considerable weight-gaining due to excess moisture accumulation.

Is It Resistant to Acids, Alkalies and Heat?

FUMEALL filter fabric is superior because it combines the proved filtering properties of virgin wool and the acid, alkali and heat-resisting qualities of **DYNEL**, a new synthetic fiber developed by Union Carbide and Carbon Chemicals Corp.

Tests to date show that **FUMEALL** operates perfectly in heat ranges up to 350° under certain acid and alkali conditions. Further tests are now being made in higher temperature ranges.

Are You Getting the Size You Want?

FUMEALL is "tailored to your needs" right in the mill. We weave bags or yardage to any size you require!

WRITE OR TELEPHONE FOR ADDITIONAL INFORMATION

INDUSTRIAL FABRICS DIVISION

Portland Woolen Mills, INC., PORTLAND 3, ORE.

*Patent Pending

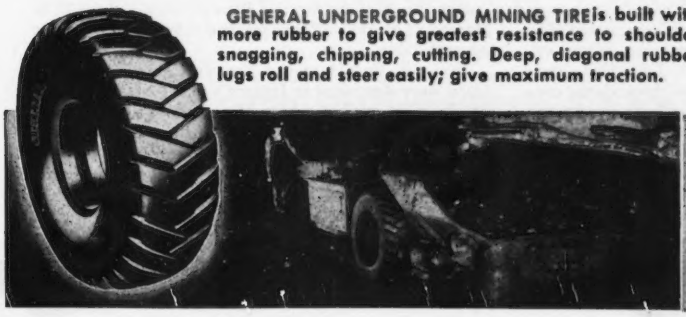
GENERAL

WORKS FASTER, SAFER, AT LOWER COST

For most work off the road

For most work on the road

GENERAL UNDERGROUND MINING TIRE is built with more rubber to give greatest resistance to shoulder snagging, chipping, cutting. Deep, diagonal rubber lugs roll and steer easily; give maximum traction.



THE GENERAL TRUCK TIRE

SPECIFY GENERAL TIRES ON YOUR NEW EQUIPMENT

HAZACORD

REMOTE CONTROL AND DRILL CORD

Yes—3 to 5 times longer life is the service you are assured with Hazacord Remote Control and Drill Cord. The durability of its extra thick tire-tread tough ZBF sheath better withstands the punishment drill cords must take...and permits approved use in remote control systems without the costly time-consuming extra protection of conduit.

Hazacord Remote Control and Drill Cord is research-developed and service tested to give uninterrupted electrical service under the severest operating conditions. Vulcanized in a continuous metal mold, the Hazaprene ZBF Sheath is dense and resilient...withstands the constant abrasion and run-overs of mine floor service day in and day out. Yet this sheath is so flexible that the cable can be repeatedly bent around a radius six times its own diameter without endangering its long life. Special fillers add strength to the cord and prevent wicking in of moisture through cable ends. This Hazard construction stands up under the excessive strain of pulling and tugging that drill cord receives.

Maximum flame-resistance—so essential to safe operation—is provided by the Hazaprene ZBF Sheath. Like other Hazacord mining cables, Hazard's Remote Control and Drill Cord more than meets the flame test requirements of the State of Pennsylvania and the U. S. Bureau of Mines, and is so marked at frequent intervals on each cable.

You will find Hazacord Remote Control and Drill Cord fully described in Hazard's new 72-page manual of electrical mining cables. If you don't already have your copy, just send us your name, title and company, and we will see that you have it promptly. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pennsylvania.

HAZARD

8541

PROVED IN PERFORMANCE

Grinnell-Saunders Valves with CHEMICALLY INERT KEL-F* DIAPHRAGMS

Pat. App. For

Grinnell-Saunders Diaphragm Valves with KEL-F Diaphragms are living up to every promise made for them! At the right are reports from typical users.

KEL-F's resistance to chemical action, low cold flow, wide range of temperature application and exceptional flex life combine to make it the most important diaphragm development in years. KEL-F is chemically inert to all organic acids and alkalies in all concentrations. It withstands chlorinated aliphatic and aromatic compounds, concentrated nitric, chromic, hydrofluoric and sulphuric acids and most solvents which readily attack rubber and previous synthetic diaphragm materials.

While KEL-F is tough and flexible, it is not resilient. To provide resiliency for proper closure of the valve and to provide added support for the KEL-F diaphragm, it is backed with a rubber cushion. A free-floating method of attachment to the compressor assures an even closing pressure on the entire surface of the weir. A tube nut which floats as the rubber cushion presses down in closing the valve, eliminates excessive pressure on the diaphragm stud. The rubber cushions the closing force, thereby reducing wear and cutting action on the diaphragm. In accelerated tests, a 2-inch valve with a KEL-F diaphragm withstood over 80,000 closures, drop tight, against 80 pounds of air under water with no leakage and no visible signs of wear. Write for complete information.

Typical performance reports . . .

1. Chlorine and HCl gas with small amounts of acetic acid and acetyl chloride at 302° F. for 900 hours. Very much superior to material it replaced.
2. Mixed aromatic and ketone solvents at 230° F. and 10 psi for three months. No sign of deterioration.
3. Chlorinated organic chemical at 158 to 194° F. and 30 to 40 psi for nine months. No failure, no shutdown, no replacement.
4. Chromyl chloride at ambient temperature and 15 psi. Diaphragm condition good at end of thirty days' test.
5. Liquid chloral saturated with HCl at 158° F. for 408 hours. Well satisfied — have placed orders for additional diaphragms.

*"KEL-F" is the registered trade name for polytrifluorochlorethylene, an exceptionally stable thermoplastic. It is produced by the M. W. Kellogg Co.

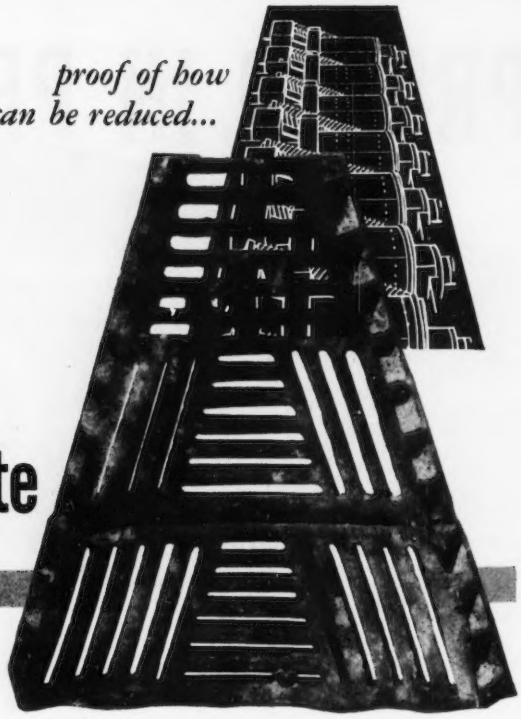
GRINNELL

WHENEVER PIPING IS INVOLVED

GRINNELL COMPANY, INC., Providence, R. I. Warehouses: Atlanta • Billings • Buffalo • Charlotte • Chicago
Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach • Los Angeles • Milwaukee • Minneapolis • New York
Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

proof of how milling costs can be reduced...

this AMSCO® Grate has milled 193,797 tons



An actual example of how AMSCO Grates last longer, reduce shutdowns and increase milling profits.

Equally Big Savings On Liners, Too!
Recent production figures on Amsco double-wave Liners in a mill grinding copper ore: 667,308 tons ground . . . at a liner cost of about a half-cent per ton! *It will pay you to investigate the long, low-cost service of Amsco Liners!*

Find out more about Amsco Liners and Grates

Be sure to ask for a copy of Bulletin 449-ML. Describes the characteristics of Amsco ball mill alloys; gives additional facts on dollar-saving installations. Free copy on request.

Here's an actual photograph that proves an important, profit-building point to users of ball mill equipment . . . *the real cost of liners and grates is the actual service cost.*

This Amsco grate has milled 193,797 tons . . . compared with just 113,000 tons for a previously used hardened steel grate which ran under identical conditions. And, during this period of 72% greater tonnage milled, *the Amsco grate required no down-time for repair.* The previously used grate started to crack at 50,000 tons—required many shutdowns for plugging holes.

Because of heavy impact, this particular Amsco Grate was made of austenitic chromium-manganese steel—one of three Amsco alloys developed for specific conditions of impact and/or abrasion. These Amsco liner and grate alloys can result in big savings on milling costs. Amsco Engineers are fully qualified to make alloy recommendations based on your operating conditions—*write today for the name of the Amsco engineer nearest you.*

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
376 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.

BRUTE STRENGTH FOR TOUGH HAULS

QUAKER CONVEYOR BELTING

for more tons hauled . . . lower cost per ton

No haul too tough . . . no ore too rough for Quaker Conveyor Belts. That's why they are used in the leading mines throughout the nation. Belts that assure minimum of maintenance and low cost conveyor operation.

Quaker Conveyor Belts are scientifically made of ply upon ply of strong, specially woven cotton duck tightly bonded together to prevent internal friction while flexing. Covers are made of resilient, torture-tested, long-lasting live rubber that resists constant abrasion, withstands continuous flexing. Precision controlled vulcanization moulds plies and covering into a belt of brute strength ready to take the toughest of loads on the heaviest hauls—defies wear, separation, breakdown.

For maximum tonnage hauled, equip your conveyors with Quaker belts. There's longer life built into each one . . . more service in every foot. Call your nearest Quaker Distributor for performance-proved Quaker Industrial Rubber Products.

FOR POSITIVE POWER
Quaker Transmission Belting is pre-tested for maximum horsepower transmission. Available for all types of drives—from fractional horsepower to the largest installations.

HOSE FOR RUGGED WEAR
There's a Quaker Hose for every use in the coal industry—from the air hose on the lowest level to the water hose in the washer.

FOR SAFETY . . . ALL WAYS
Quaker's Mine Trolley Cable Guard offers protection for mine cables. It is specially compounded of synthetic rubber to resist mine damp, acid and water. It is also resistant to fire which adds an extra safety margin and prevents breakdown.

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Division of H. K. Porter Company, Inc.
PHILADELPHIA 24, PA.
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QUAKER RUBBER PRODUCTS *custom made for every industrial use*

QUAKER RUBBER CORPORATION · PHILADELPHIA, PA. · QUALITY SINCE 1899

An important CHROME-MAGNESITE Refractory for metallurgical furnaces

- HIGH TEMPERATURE STABILITY IN STRENGTH AND VOLUME
- GOOD SPALLING RESISTANCE
- HIGHLY RESISTANT TO SLAGGING AND EROSION

CHROMEX B is an extremely hard burned, dense, basic refractory especially suited for use under severe service conditions in vulnerable parts of smelting, refining and melting furnaces.

Important Uses of CHROMEX B include—

Copper and nickel converter linings
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Aluminum melting furnace bottoms
Lead dross reverberatory furnace walls and roofs
Copper blast furnace hearths and setters
Non-ferrous secondary metal furnace parts

Harbison-Walker Products comprise all types and classes of commercial basic, silica, alumina-silica, and alumina refractories.

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AND SUBSIDIARIES
WORLD'S LARGEST PRODUCER OF REFRACTORIES
General Offices . . . . . Pittsburgh 22, Pennsylvania

Case histories prove longer life

These actual service tests, involving the crushing of millions of tons of ore, represent data on which you can rely. Years of service have confirmed the results of this carefully-run test.

Write for 32 pp reprint of an informative paper published by the Amer. Inst. of Mining and Metallurgical Engrs., giving results of wear tests on grinding ball materials—FREE!

Case No. 1

Tests in Colorado between 1938-40: Molybdenite ore—quartz and feldspar, principal abrasives.

Service: Marcy 9′ × 9′ Trunnion overflow type ball mills grinding minus ¼″ siliceous ore to 62% minus 100 mesh. Mill pump density 75% solids. Mill speed 20 rpm: balls charged were 3″ dia.

Comparison: Under similar conditions, between two sets of manganese steel liners and six sets of high carbon chromium-molybdenum steel, (normalised and tempered to average 360 brinell).

Liner type: Shell (Barrel liners), ship lap type; weight 33,500 lb. approx. per set.

Results:	*Hours in Service*	*Net Wear Lb/Hr**	*Per cent Scrap*
Manganese steel (average of two sets)	4979	4·59	34·2
Cr-Mo steel (average of 6 sets)	5561	3·97	34·3

* Net wear per hour represents metal actually worn away.

The manganese steel liners wore 16% faster than the chrome-molybdenum steel liners.

Case No. 2

Tests in Colorado, 1943: Molybdenite ore—quartz and feldspar, principal abrasives.

Service: Marcy 9′ × 8′ grate discharge type ball mills grinding minus ¼″ siliceous ore to 55% minus 100 mesh. Mill pulp density 75% solids. Mill speed 20 rpm: balls charged were 3″ dia.

Comparison: Under similar conditions between two sets manganese steel liners and eleven sets of high carbon chromium-molybdenum steel, (normalised and tempered to average 400 brinell).

Liner type: Shell (Barrel liners), ship lap type of special thin design for high capacity mill operation; weight 26,000 lb. approx. per set.

Results:	*Hours service*	*Net Wear Lb/Hr*	*Tons Ground*	*Net Wear Lb/Ton*	*Per cent Scrap*
Manganese steel (Average of 2 sets)	2441	6·14	209824	·0715	38·7*
Cr-Mo steel (average of 11 sets)	3018	5·02	249002	·0616	42·8

*worn beyond desired limits.

The manganese steel liners wore 22% faster (per hour basis) or 16% faster (per ton basis) than the chrome-molybdenum liners.

Climax Molybdenum Company

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Please send your FREE Reprint on "Wear Tests"

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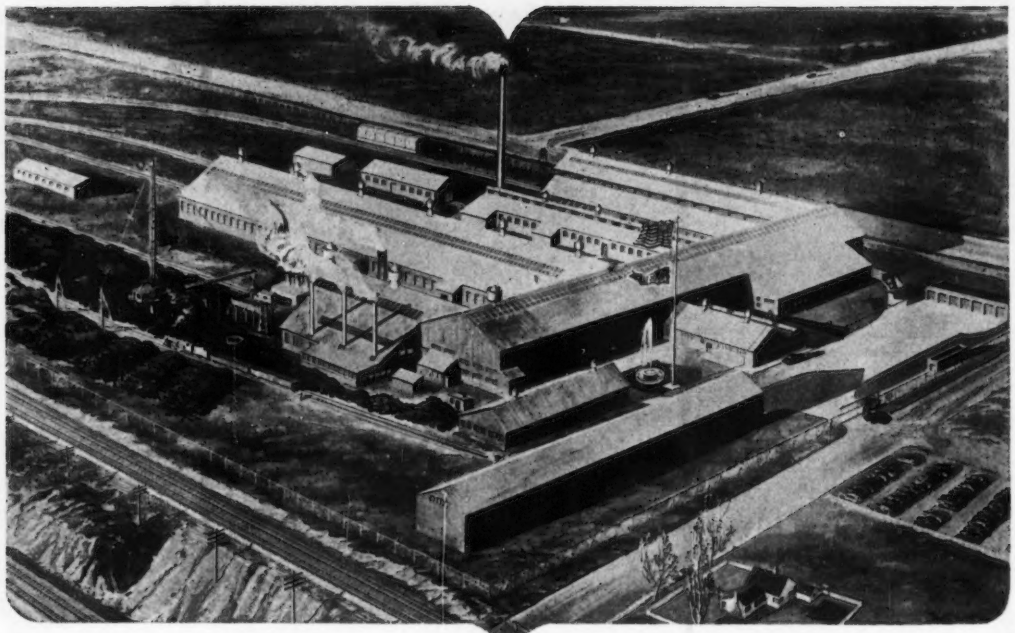


adequate facilities...

For a complete mill or process plant... for additions to or modernization of existing property... or for specialized equipment, the facilities behind Stearns-Roger service are well suited to the assignment.

From our Denver shops, pictured above, hundreds of carloads of machinery and process equipment have moved out to every state in the Union and to many foreign countries.

UNDIVIDED RESPONSIBILITY

- ENGINEERING
- DESIGNING
- MANUFACTURING
- CONSTRUCTION

Manufacturing is but one phase of our COMPLETE SERVICE, which also includes engineering and field construction "know how" reflecting 65 years experience.

Stearns-Roger

THE STEARNS-ROGER MFG. CO. DENVER COLORADO

PLAN
LOAD
DETONATE

For better BLASTING!

WITH PRIMACORD

The many advantages of Primacord make it the choice where safety, simplicity of hookup, and ease of handling are factors to be considered.

Primacord, because of its speed, detonates practically instantaneously, yet the infinitesimal lag between holes and rows of holes obtains greatest results from a minimum quantity of explosives.

Because it cannot be set off by friction, sparks or ordinary shock and is impervious to stray electrical currents, Primacord offers a safety factor to many blasting operations.

Primacord is wound on easy to handle lightweight spools, so that loading and hook-ups are done easily.

4 Types of Primacord

Primacord is made in four standard types, each designed to obtain greatest effectiveness under varying working conditions — each with the same high degree of dependability.

PLAIN PRIMACORD. For shallow holes and surface trunkline use, Plain Primacord is recommended. Although light in weight (a 1000-foot spool weighs only 19 lbs.) it has tensile strength of 113 lbs.

REINFORCED PRIMACORD. For deep holes where extra tensile strength or resistance to abrasion are desirable, depend on Reinforced Primacord. Tough, but resilient and easy to handle, Reinforced Primacord has the same detonating qualities as other Primacord-Bickford types. Weight 20 lbs. per 1000-ft. spool.

WIRE COUNTERED PRIMACORD. Armored with closely stranded brass wire, Wire Countered Primacord is the answer to problems involving deep, ragged holes and high abrasive conditions. The wire sheath also increases the tensile strength to 220 lbs. Weight per 1000-ft. spool, 35 lbs.

PLASTIC REINFORCED PRIMACORD. To meet the demand for a strong, waterproof detonating cord resistant to abrasion and to the acids commonly encountered, Ensign-Bickford developed Plastic Reinforced Primacord. With tensile strength of 250 lbs., users find it ideal for extremely deep holes, river crossings, or where water is a problem. Weighs 22 lbs. per 1000-ft. spool.

Blasters who use Primacord consistently agree there is no substitute. For complete information, consult your explosives supplier . . . or write to us direct.

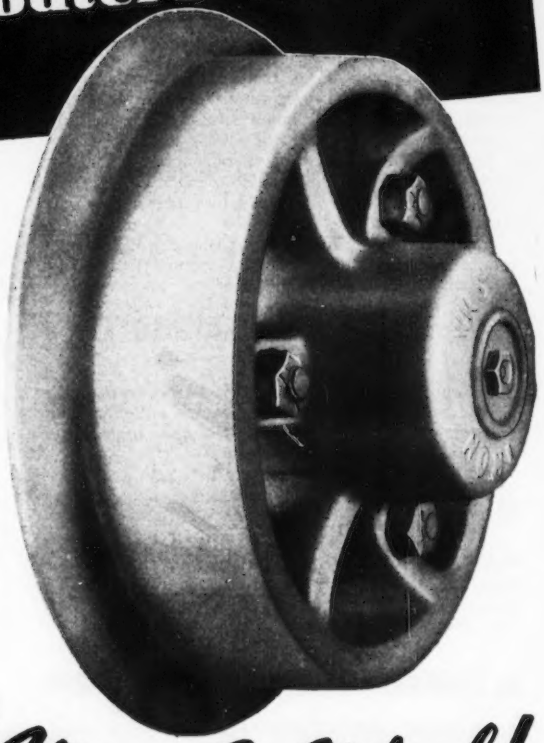
THE ENSIGN-BICKFORD COMPANY
Simsbury, Connecticut
Also Ensign-Bickford Safety Fuse — Since 1836

P-51

PRIMACORD-BICKFORD Detonating • Fuse •

Performance records prove...

...with practically no maintenance..you'll haul up to 50% greater loads on S-D "Floaters"...



Tests conducted by independent engineering firms and performance records at the mine have proved that locomotives will pull up to 50% greater loads, when cars are equipped with S-D "Floater" Wheels, instead of wheels with other types of precision bearings. But this saving in power and time is only a portion of the profit you gain by using S-D "Floaters." When it comes to maintenance you really pick up profit because S-D "Floaters" literally "hate to be greased." One greasing in 5 years is often sufficient. Common labor can demount and remount a "floater" wheel easily . . . in less time than it takes to smoke a cigarette, because no adjustment whatsoever is necessary on the bearings. Add to this the fact that the big cause of bearing failure (bearings running too tight or loose) has been eliminated and you can understand why more and more operators are specifying S-D "Floaters" for all wheel replacements. For complete information, write Sanford-Day Iron Works, Knoxville, Tenn.

America's No. 1 Mine Car Wheel!

SANFORD - DAY IRON WORKS

HOW MUCH WATER IN A TON OF STEEL?

Of all the raw materials used in making steel, water is by far the largest single component. From blast furnaces to rollers, 120 tons of water are used to make one ton of steel. Johnston Engineers do not pretend to be steel men or mining men, but they do know how to move water—where you want it ... when you want it. In mining, as in the steel industry, Johnston Vertical Turbine Pumps have been the economical and dependable solution to many fluid-handling problems. Whether your pumping application calls for big gallonage or small, high lift or low ... our engineers will demonstrate how a Johnston can save money on *your* job.

Johnston Pump Company, 2324 East 49th Street, Los Angeles 58, Calif. Dealers in all principal cities.

"There's a Johnston Pump for every purpose"

LITTLE BEAVER
For 4" Minimum Well Size

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Big Pump Features and Small Pump Economy

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Either Oil or Water Lubricated

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For Industrial Applications

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Large Capacity at Low to Medium Heads

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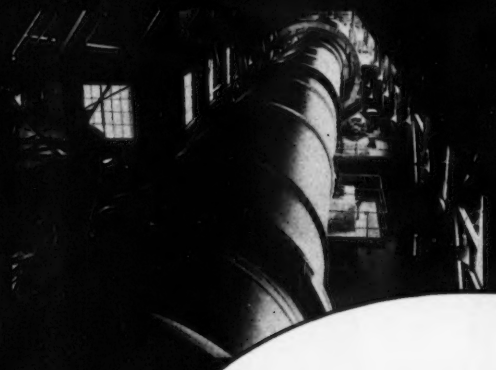
For Volatile Fluids and Hot Liquids

ROTARY SINTERING KILNS



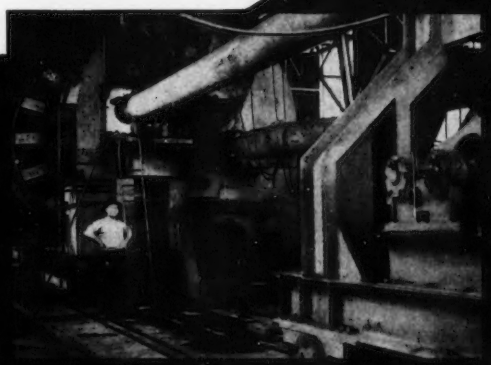
Iron ore, manganese ore, phosphates of all sizes, flotation concentrates and flue dust alone or mixed, can be sintered regardless of moisture and carbon content.

Sintering temperature easily regulated and maintained as desired, producing sinter of proper porosity and hardness, thus saving blast furnace fuel.

Materials sintered without fines, eliminating screening and rejects.

Any available gas, oil or pulverized solid fuel may be used.

Low power consumption—7 to 8 kwh per ton of sinter.



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The New TELSMITH GYRASPHERE Crushers...

Send for Bulletin No. 274

TWO new MODELS

Style S—Standard
Style FC—Fine Crushing

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2. Larger Roller Thrust Bearings, both now located at top of eccentric.
3. More Eccentric Bearing Area in upper crushing zone.
4. Longer Springs to pass larger tramp iron.
5. New Location of Drive Gears for more economical operation.
6. Easier Accessibility for lower maintenance.
7. Available with either coarse or medium bowl.

Style FC—Fine Crushing Gyrasphere has these additional improvements—

1. New Feed Distributor for even feeding and a more uniform product.
2. Different Shape of Mantle and Concave with longer parallel crushing zone for finer product.
3. New Gun-Lock type mantle and concave holding devices — automatically self-tightening, easier to change.
4. More Springs for greater crushing pressures.
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Y-8

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Over 30 years of experience in the design and manufacture of drilling equipment is the big reason why Acker Drills stand-up year after year, job after job. *Write for Bulletin 33. EM*

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330 W. 42ND ST., N. Y. 18, N. Y.

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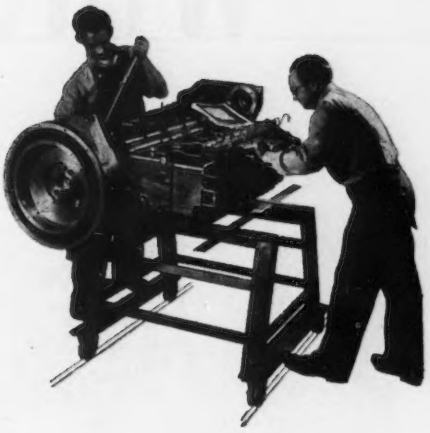
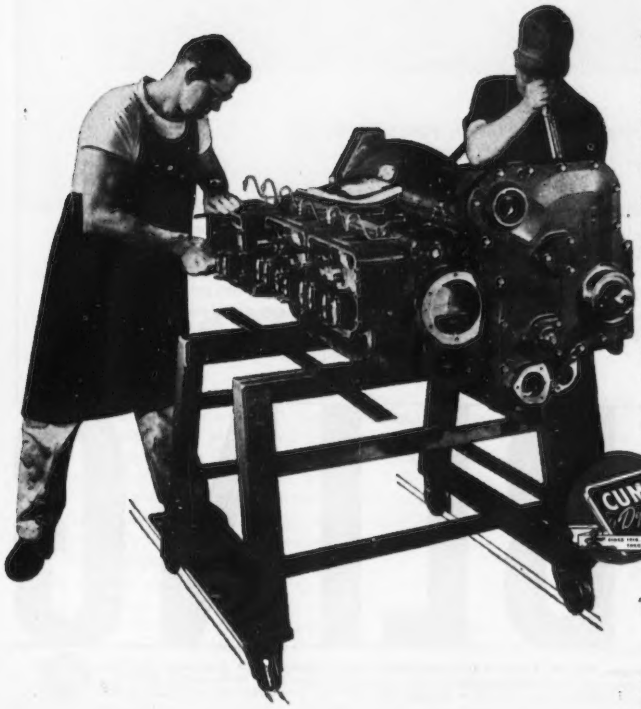


Extra care in building means extra profits for power users



Typical of the extra care that goes into the building of *every* rugged, dependable Diesel is the tear-down of the engine after assembly. First the engine is run in on the test block. Then it is completely torn down and carefully re-inspected. After that it is re-assembled and tested *again*.

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Lightweight High-speed Diesel Engines (50-550 hp) for: On-highway trucks • off-highway trucks • buses • tractors • earth-movers • shovels • cranes • industrial locomotives • air compressors • logging yarders and loaders • drilling rigs • centrifugal pumps • generator sets and power units • work boats and pleasure craft.

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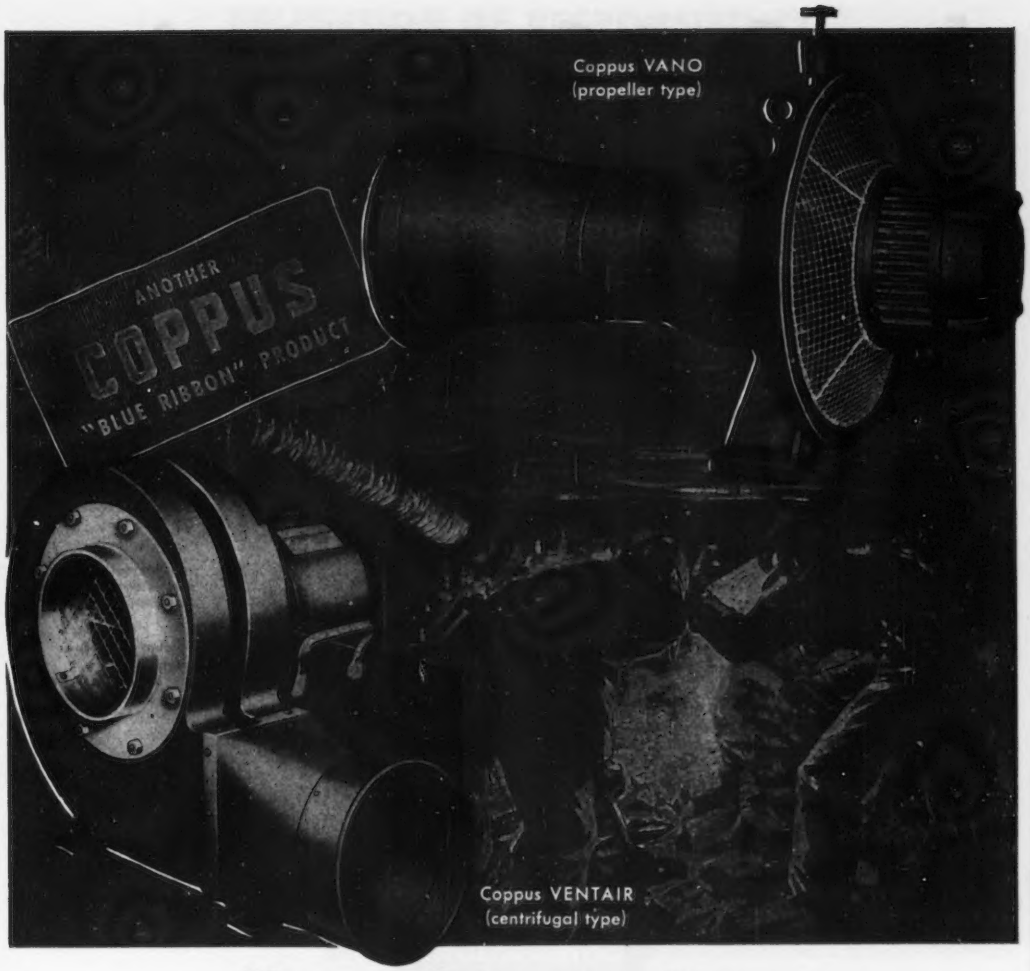

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Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, Worcester 2, Massachusetts.

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- ✱ *for* **separation of minerals of different specific gravity in ores at sizes generally minus 10 mesh.**
- ✱ *for* **recovery of liberated values too coarse for flotation.**
- ✱ *for* **recovery of other ore values from flotation tailing.**
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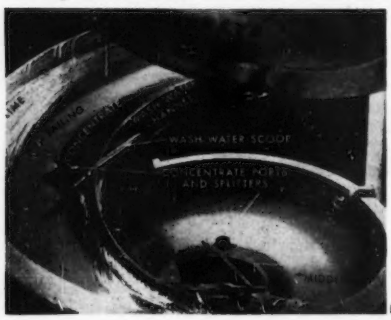
- ✱ *for* **cleaning minus ¼ inch bituminous or anthracite coal.**

Low cost of installation
Low operating costs
No moving parts

Concentrating action of Humphreys Spiral—Note wide black band of concentrate entering upper outlet, which is set for a wide cut, also narrow black band of middling entering lower outlet set for thin cut. In cleaning fine coal, phosphate rock and mica, refuse and middling are discharged from the concentrate ports and cleaned product follows the path shown as tailing.



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A testing laboratory is maintained in Denver by the Engineering Division of The Humphreys Investment Company. Results obtainable in a full size plant may be determined by tests of a representative sample of minerals or coal weighing 300-500 pounds.

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ENGINEERING DIVISION
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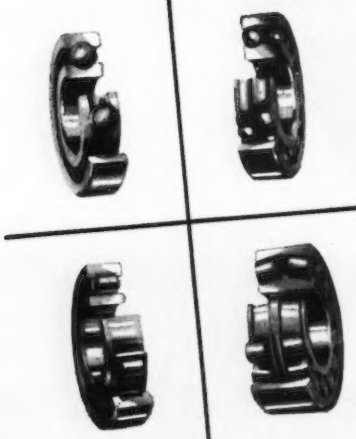

Over the years, products acquire a value above and beyond their mechanical qualities—a value proved by their *acceptance* throughout industry. This is especially true of SKF ball and roller bearings, preferred by all industry for one or more of eight good reasons. So when you specify, let preference be your guide. 7200

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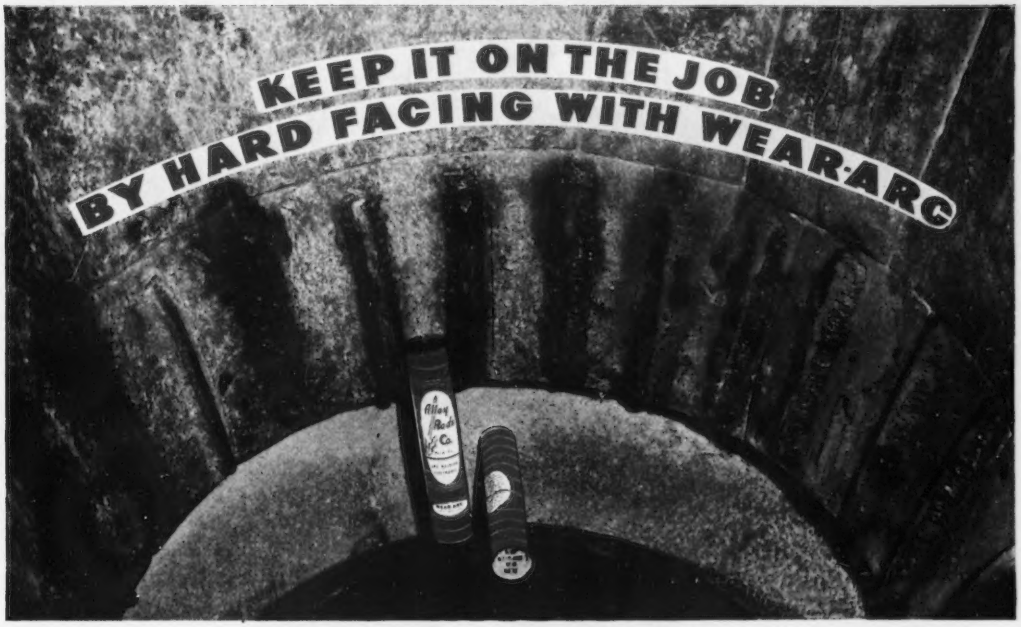

This Bell Crusher Concave was completely salvaged by welding, in vertical position, 1" round manganese steel bars to the worn manganese steel casting. The bars help hold and crush hard stone. Bars were welded with 5/32" WEAR-ARC WH electrodes and hardfaced with 3/16" WEAR-ARC 12 electrodes to provide an extremely hard wearing surface against impact and abrasion.

Bucket tooth life can be increased many times by welding manganese steel wedge bars to the worn tooth point with 3/16" WEAR-ARC WH electrodes, and by hard facing the entire surface of the tooth with 3/16" WEAR-ARC 12, electrodes

WEAR-ARC Will Last Longer Against Abrasion and Impact

To reclaim worn equipment and protect parts against excessive wear, you will find one, or a combination of two, of the seven basic WEAR-ARC hard facing electrodes does the best job . . . increases life as much as four times or more.

WEAR-ARC WH is ideal for build up and high strength welds on manganese steel; WEAR-ARC 12 for providing that hard wearing surface. Ask for bulletin No. 10550, illustrating and describing properties and welding procedures for the complete line of Wear-Arc hard facing alloys.

Ninty-five pound impactor hammers of manganese steel are built up with WEAR-ARC WH and hard faced with WEAR-ARC 12. Life of new hammers can be increased many times by hard facing with WEAR-ARC 12 electrodes.

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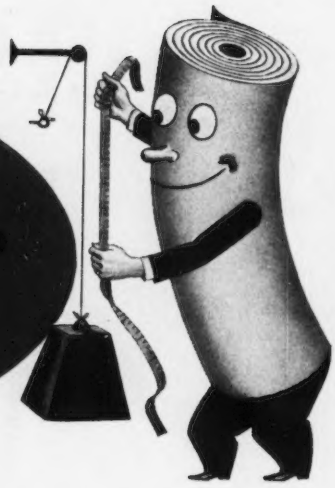

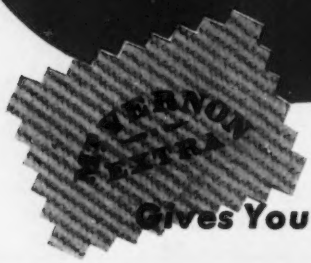

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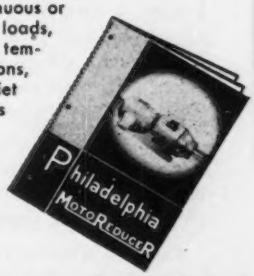

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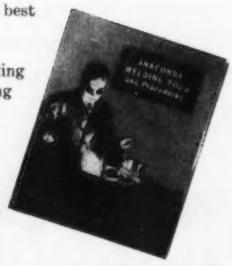

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This 28 page booklet summarizes many of the basic facts you should know about modern COTTRELL Precipitators—the various types available, how they operate, principal types of electrode systems and rectifiers, shell constructions, etc. As long as the supply lasts, a free copy will be sent you on request to our nearest office. Ask for Bulletin No. C 103.

28 PAGES
of helpful facts to know about
COTTRELL ELECTRICAL PRECIPITATORS

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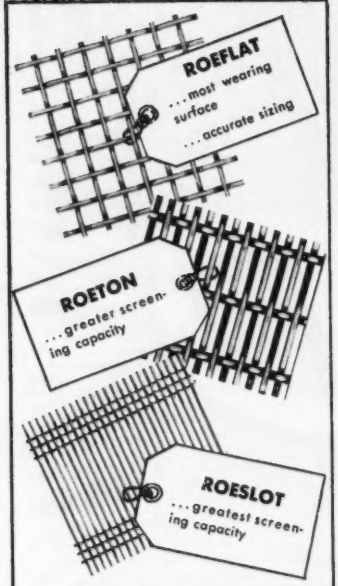

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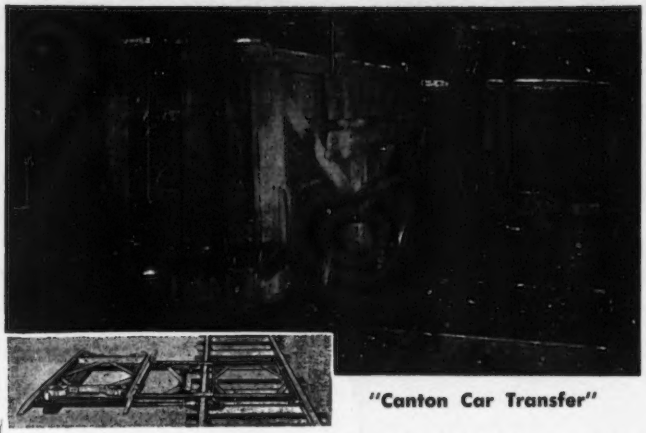

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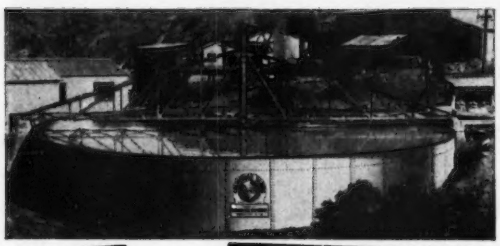

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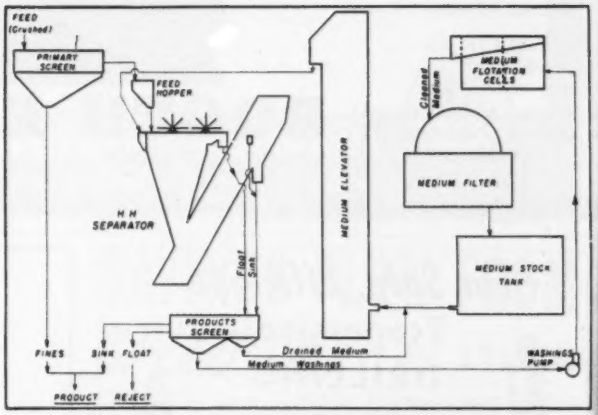

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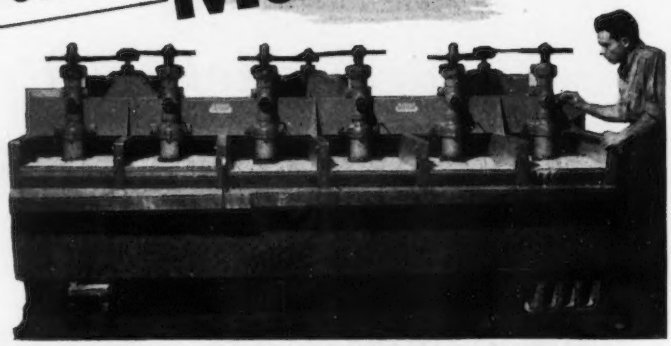

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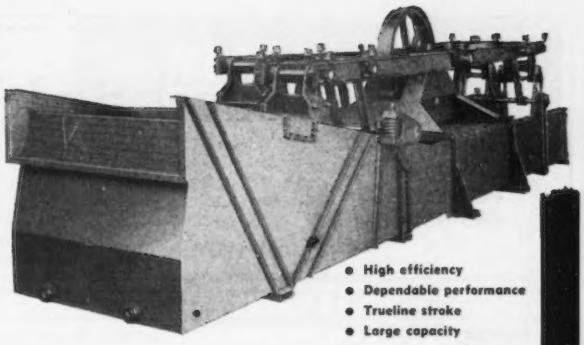

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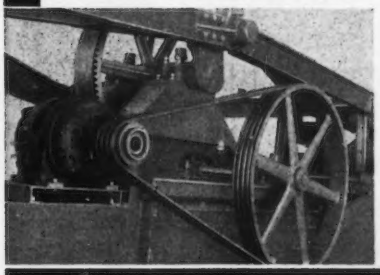

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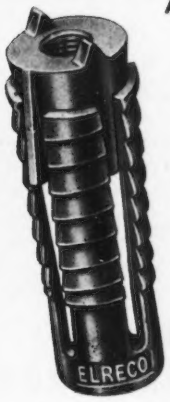

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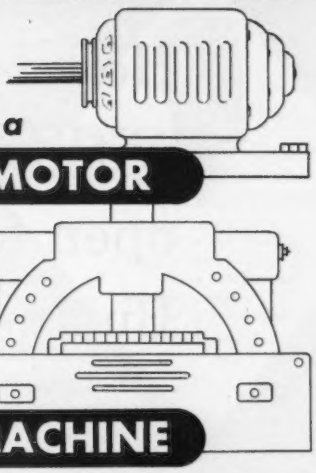

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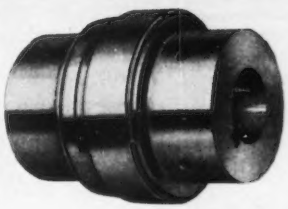

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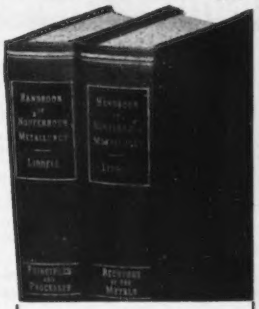

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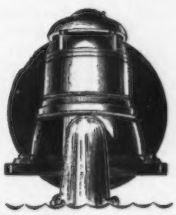

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AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches —to a page. E.M.J.

NEW ADVERTISEMENTS received by 10 A.M. February 16th, at the New York office, 330 W. 42nd St., N. Y. 18, N. Y., will appear in the issue of March subject to limitations of space available.

CHIEF DESIGNER

Administrative Ability and experience in Ore Milling and Industrial Plant Design.

So. Calif. Engineering Firm established since 1915.

Permanent position. **Excellent salary.** Send full experience record and references 1st letter.

P8553 Engineering & Mining Journal
1111 Wilshire Blvd.,
Los Angeles 17, Calif.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

REQUIRED FOR Southwest two experienced draftsmen for design and detailing wood and steel structures, foundations, reinforced concrete and other allied work. Pleasant working conditions. Pension and insurance benefits. Personal traveling expenses refunded. Apply by letter with full details, age, education, experience, etc., to American Smelting and Refining Company, 1112 Mills Building, El Paso, Texas.

JUNIOR MINE Engineer. Recent college graduate, competent underground surveyor and draftsman, standard three year contract, single, free transportation furnished to Bolivia by air, four weeks vacation yearly plus free living quarters, salary $2,300 yearly plus yearly bonus one month's salary. P 8818, Engineering & Mining Jl.

MILL SUPERINTENDENTS (2) required by large mining company for copper flotation mills in Peru and Bolivia, college graduates, with at least ten years experience base metal flotation and working knowledge of Spanish; previous experience as mill superintendent or assistant is essential. Standard three-year contract. Salary attractive, future possibilities good. Junior Metallurgist, recent technical college graduate, also required. P 8617, Engineering & Mining Jl.

POSITIONS WANTED

ENGINEER—WIDE experience mining metallurgical design construction metal and nonmetal. Available for consulting or operation. Foreign service acceptable. PW 8359, Engineering & Mining Jl.

RECENT GRADUATE, 30, with B.S. degrees in mining engineering and geology desires position as junior engineer or geologist. 5 years practical mining experience before college. College record considerably above average. Go anywhere. Available immediately. PW 8713, Engineering & Mining Jl.

MINING ENGINEER, 26 years experience in exploration, development, plant construction, and production, with mining activities in the Southwest, Alaska, and the Orient. Qualified for technical or managerial assignment. Married. PW 8704, Engineering & Mining Jl.

WANTED

ANYTHING within reason that is wanted in the field served by Engineering & Mining Journal can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

WANTED
GRADUATE ENGINEER

National organization with over 20 plants, desires graduate engineer for position as Assistant Plant Manager following a period of approximately one year or less as plant engineer to establish himself and plant engineering department. Experience in gypsum, lime or cement preferred but not required. Plant is integrated from raw materials (quarry) to finished product, employing approximately 275 people. Submit full details with reply including salary required.

P 8549, Engineering & Mining Journal, 520 N. Michigan Ave., Chicago 11, Ill.

SALES ENGINEERS WANTED

Young men for sales work by manufacturer of heavy machinery. Knowledge of crushing, milling and processing as related to mining and aggregate and cement production advantageous but not necessary. Qualified applicants afforded opportunity for rapid advancement. Give full particulars; age, education, previous experience in these industries and present position. All replies confidential. Our Sales Department has been advised of this advertisement.

SW 8739, Engineering & Mining Journal
520 N. Michigan Ave., Chicago 11, Ill.

Experienced Reverberatory Smelter Man, Technical Graduate, for supervisory position. Must be able to make metallurgical calculations for furnace controls.

Experienced cottrell supervisor, technical background, will be in charge of cottrell installations containing both pipe treaters and rod curtain units.

Analytical Inorganic Chemist, BS or MS with a minimum of ten years of diversified experience in analysis of nonferrous ores, metals and smelter products required for a supervisory nonroutine position. Familiarity with spectrographic and instrumental methods beneficial, but not essential. Particular stress is laid upon applicants' experience in successful supervision of laboratory personnel.

Location Southwest. Salaries open.
Apply: Personnel manager,
Box 1461 Texas City, Texas

WANTED

Rock Crushing and Milling Manufacturer requires graduate Engineer for production work. Industrial experience in crushing and milling essential. Mechanical aptitude desirable. Applicant to include all details and salary desired in first letter.

P7942, Engineering & Mining Journal
330 West 42nd St., New York 18

DESIGNERS & DRAFTSMEN

With experience in ore dressing plants, smelters and related machinery wanted for permanent positions with active engineering and manufacturing organization. Location: Eastern, Middlewest, West. Salary based on experience. Mail full details of training and experience to

P8623, Engineering & Mining Journal
68 Post St., San Francisco 4, Calif.

DESIGN ENGINEERS and DRAFTSMEN

Mechanical
Structural
Concrete
Piping

Experienced in Ore Milling and Industrial Plant design.

Large Engineering Company Location So. Calif.

Send experience record and references first letter.

P8554 Engineering & Mining Journal
1111 Wilshire Blvd., Los Angeles 17, Calif.

FINANCE WANTED

For improvements and machinery for rich copper-gold mine. Has 16,500 tons proven ore averaging 20 per cent copper, $4.00 in gold per ton. Mine is ready to ship ore soon as camp built and machinery installed. Excellent engineers report. Will stand fullest investigation. Liberal interest for nominal amount of capital.

BO8744 Engineering & Mining Journal
330 W. 42nd St., New York 18, N. Y.

DEPENDABLE EQUIPMENT AT A SAVINGS IN TIME AND COST

SLIP RING MOTORS

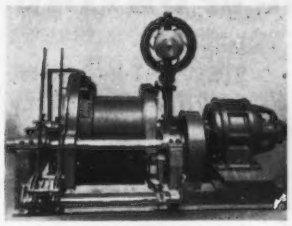
1—5 HP Gen. Elect. 3/60/220, 100 RPM.
1—15 HP Fair.-Morse, 3/60/440, 900 RPM.
1—15 HP West., 3/60/440, 1200 RPM.
1—20 HP Gen. Elect. 3/60/440, 720 RPM.
3—20 HP Gen. Elect., 3/60/440, 1200 RPM.
1—30 HP Gen. Elect., 3/60/440, 1755 RPM.
1—40 HP West., 3/60/440, 860 RPM.
1—50 HP Gen. Elect., 3/60/440, 850 RPM.
1—50 HP West., 3/60/440, 1160 RPM.
1—52 HP Gen. Elect., 3/60/440, 550 RPM.
1—52 HP Gen. Elect., 3/60/220, 860 RPM
1—75 HP Gen. Elect., 3/60/440, 450 RPM.
1—75 HP West., 3/60/440, 885 RPM.
1—82 HP Gen. Elect., 3/60/440, 495 RPM.
1—100 HP Gen. Elect., 3/60/440, 720 RPM.
2—165 HP Gen. Elect., 3/60/440, 450 RPM.
1—200 HP West., 3/60/440, 580 RPM.
1—200 HP Gen. Elect., 3/60/220-440, 435 RPM.
1—20 HP Allis-Chalmers, 3/60/2200, 860 RPM.
2—50 HP Gen. Elect., 3/60/2200, 900 RPM.

LOCOMOTIVES

1—1½ ton Mancha "Little Trammer" battery, 18"-24" gauge.
2—2½ ton Mancha battery, 18"-24" gauge.
1—2½ ton Whitcomb battery, 24" gauge.
2—5 ton West. battery, 24"-36" gauge.
2—7 ton Gen. Elect. battery, 36" gauge, permissible type.
2—8 ton Gen. Elect. battery, 36" gauge.
4—10 ton Atlas battery, 36" gauge.
1—6 ton Goodman trolley, 36" gauge.
2—6½ ton Gen. Elect. trolley, 36" gauge.
1—5" x 10" Porter compressed air.
1—5½" x 10" Baldwin compressed air.
1—3 ton Ruth. gas engine driven.
2—18 ton Davenport steam locomotives.

THICKENERS

1—Morse ±2 low head thickener mechanism and superstructure for 16' x 8' tank.
1—Dorr 3 tray, 4 compartment thickener, steel tank 40' diameter x 30' high.



ELECTRIC HOISTS

1—±0 Vulcan 11 HP single drum.
1—±1½ Vulcan 22 HP double drum.
1—±22-C Vulcan 35 HP single drum.
2—±4½ Vulcan 52 HP single drum.
1—±23-ELF Vulcan 80 HP single drum.
1—150 HP single drum hoist.
1—60-100 HP Vulcan single drum.
1—125-165 HP Vulcan single drum.
1—125-165 HP Vulcan double drum.
1—Lidgerwood 3-drum 80 HP contractor's type.

BALL AND ROD MILLS

1—30" x 24" new Morse batch mill.
1—4' x 4' standard ball mill.
2—6' x 36" Hardinge conical ball mills.
2—±64½ Marcy ball mills.
1—6' x 8' Marcy ball mill.
2—8' x 22" Hardinge conical pebble mills.
1—3' x 6' Dewce tube mill.

COMPRESSORS

1—80 CFM 6" x 5" Worthington.
1—90 CFM 8" x 8" Gardner.
1—131 CFM 8¼" & 4¾" x 5" Chicago-Pneumatic.
1—139 CFM 8⅝" x 4¾" x 5" Chicago-Pneumatic.
1—156 CFM 7" & 5¾" x 5" Gardner-Denver.
1—172 CFM 10½" x 4¾" x 6" Rix.
2—293 CFM 12" & 6½" x 10" Ingersoll-Rand.
1—317 CFM 7" & 5¾" x 5" Gardner-Denver.
1—382 CFM 9⅜" & 5½" x 5½" Chicago-Pneumatic.
1—447 CFM 14" & 7½" x 12" Ingersoll-Rand.
1—527 CFM 9¾" & 6" x 7" Gardner-Denver.
1—637 CFM 14" & 8¾" x 10" Sullivan.
1—800 CFM 18" & 11" x 16" Ingersoll-Rand.
1—858 CFM 19" & 12" x 16" Ingersoll-Rand.

DIAPHRAGM PUMPS

1—2" Morse Bros.
1—3" Gould's.
1—4" Dorrco.

MULTI-STAGE PUMPS

1—2" 2-Stage Ing.-Rand motor pump.
1—2" 4-Stage Hill centrifugal pump.
1—2" 6-Stage Union centrifugal pump.
4—2½" 4-Stage Penn. centrifugal pumps.
1—2½" 6-Stage Pacific centrifugal pump.
1—3" 3-Stage Hill centrifugal pump.
1—3" 4-Stage Buffalo centrifugal pump.
2—3" 5-Stage United centrifugal pumps.
4—3" 6-Stage United Centrifugal pumps.
1—4" 2-Stage Platt centrifugal pump.
1—6" 8-Stage Manistee centrifugal pump.

BETTER MACHINERY — IT'S FULLY RECONDITIONED

ESTABLISHED 1898

MORSE BROS. MACHINERY CO.

P.O. BOX 1708 DENVER, COLORADO, U. S. A. CABLE "MORSE"

COMPLETE ORE-MILLING CONCENTRATION PLANTS · FLOTATION · MACHINERY · CYANIDE · AMALGAMATION

General Office and Plant: 2900 BRIGHTON BLVD., DENVER, COLO.

OPEN PIT MINING

Contractor with excellent equipment and experienced personnel interested in excavating, material handling, or open pit mining work.

CW1319—Engineering & Mining Journal
330 W. 42nd St., New York 18, N. Y.

WANTED

Large engineering firm wishes to acquire several complete plants through purchase of (1) capital stock, (2) assets, (3) machinery and equipment whole or in part. Personnel retained where possible, strictest confidence.

Box 1231, 1474 Broadway, New York 18, N. Y.

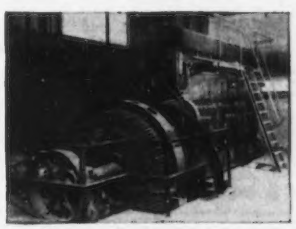
ANTIMONY MINE

(in Peru, South America)

Holdings 47 hectares (116 acres), comprising 47 claims. Enormous deposits of Mineral calculated to be 370,000 Tons, containing 20% Stibium, which can very easily be selected to 50% for exportation, or if a foundry is installed approximately 74,000 tons of 100% Stibium can be extracted. Fast production of selection of 50% exported only 200 tons. Will sell everything outright for $60,000—or enter in partnership with right parson.

Write for details to Jorge Espinosa Bustamante y Cia. S.A., Lampa 170, Lima, Peru, South America.

FOR SALE



500 KW Worthington Diesel Generator Set, complete in every respect. 2400 volt. Excellent buy. Includes generator, panel board, starting equip., muffler, intake and cooling equip. Approx. one-third new price. New spare parts available.

WRITE OR WIRE FOR FULL DETAILS

ROGER PIERCE EQUIPMENT SALES CO.

808 Newhouse Bldg. Salt Lake City, Utah

CLASSIFIER: 1—Wemco, 78" spiral, 32' steel tank, hydraulic lift, 10 H.P. AC. NEW. Unused.
COMPRESSORS: Sullivan WN4, angle compound, 22 x 13 x 14 with 500 H.P. synchronous motor. Worthington 29 x 21 x 23 with 600 H.P. synchronous motor.
CRUSHERS, GYRATORY: Various makes, sizes 12" x 44" up to 42" x 134".
CRUSHERS, JAW: Various makes, 4" x 5" to 48" x 60".
CRUSHERS, REDUCTION: Symons 2 ft., 3 ft. and 4 ft. Telsmith 2 ft., 3 ft. and 4 ft. Gyrasphere. Traylor 3 ft. and 4 ft., type TY.
CRUSHERS, SPECIAL: 1—Allis Chalmers Superior 30" and one 7½ K. Gyratory. 1—Farrell 24 x 36" Jaw.
DRYERS & KILNS: 1—Ruggles Coles, Class XAIB, double shell, 104" dia., 65 ft., ⅜" plate, and 1—Ruggles Coles XF14, 90" x 60' with or without auxiliary equipment. 1—Single shell 10' x 90' heavy duty.
DRAG SCRAPER: Sauerman 60 H.P., 3 drum, 1200 ft. inhaul, 1900 ft. outhaul cable, with two 1½ yd. Crescent buckets.
FANS: 2—Buffalo Forge Co. ±12 Turbo Conoidal Fans with 50 H.P. AC motors.
SCREEN: 1—Revolving, roller screen, heavy duty for scalping 6' dia. x 12 ft. open end.
SAUERMAN SLACKLINE MAST—100 ft. Mast only.
MINE HOISTS: Single and double drum 150 H.P. to 2500 H.P.
SHOVELS: 1—Bucyrus Erie 120-B, 4 yd. electric; also, one Bucyrus Erie 170-B, 6½ yd. electric, 3 phase, 60 cycle, 2200 or 4000 volt. 1—Bucyrus Erie 54-B diesel, 2½ yd. shovel or dragline. Used only 90 days. 1—Bucyrus Erie 2½ yd. diesel shovel and dragline. 1—Lorain 57, 1¼ yd. Diesel Shovel.
DRAGLINES: 6—Crawler tread, diesel powered Cranes, late type, current models, P & H, Northwest, Lorain, Osgood, 2 yd. and 2½ yd. capacity, with 60 to 80 ft. booms, wide treads and long cats.
TANKS: 2—Tanks for oil storage, horizontal, 6' dia. x 28 ft.

A. J. O'NEILL

Lansdowne, Pa.

Phila. Phones: Madison 3-8300—3-8301

ELECTRICAL CABLE

- for every industrial and power application.
- Special construction. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular supplies.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2674 N. Clybourn Ave. Chicago 14, Ill.

RELAYING RAIL

All Sizes
Track Accessories

LEFTON INDUSTRIAL CORP.
Genl. Office: 212 Victor St.
St. Louis 4, Mo.

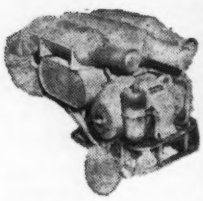
NEW
STEEL ASCE RAIL
16 lb. to 40 lb.
20 ft. and 30 ft. Lengths
With Angle Bars
Immediate Delivery
LEVIN STEEL PRODUCTS
593 Market St., San Francisco 5

AMONG ITS MANY USES:

- supplies heat indoors and outdoors
- clean hot air for drying and curing
- melts ice and snow
- pre-heats airplane and other engines
- keeps men and machinery warm
- thaws fuel lines and controls
- heats tanks
- handy for shipboard use

Lots of HOT AIR for HEATING or DRYING

anywhere at a moment's notice—with an all-purpose portable!



STEWART-WARNER *SOUTHWIND* HEATER

Priced at a fraction of original Govt. cost

Now $125 F.O.B. Salt Lake

Net wt. 200 lbs. Size 30x30x48.

Complete with air-cooled gasoline engine, tank, heater. Produces 100,000 B.T.U.'s per hour.

These durable heat machines have been used to good advantage for many years by U S Armed Forces, contractors, garages, cabins, farmers, airports, lumbermen and all operations requiring HEAT

- **MAIL ORDERS FILLED** Remit check and we'll pay the freight

ORDER YOUR HEATER NOW! IMMEDIATE DELIVERY!

WESTERN SALVAGE & SUPPLY CO., INC.

1570 So. 2nd West — 7-1528 — Salt Lake City 4, Utah

4—Ball Mills 6'x6', Grate Discharge.
3—60" Akins Simplex High Weir Classifiers.
2—36" Akins Duplex-Submerged Spiral (DDPS) Classifiers.
2—Morse Bros. 8 Disc. 8'6" Dia. Filters.
8—Tyler Hummer Screens, 4x5, equipped with V-16 and V-50 units.
Miscellaneous sizes Centrifugal Pumps.
Strong-Scott Unipulve Coal Pulverizers: 1—±40; 3—±30; 1—±20.
1—Webb Corp.—Blake Type Jaw Crusher, 6" x 15"; Cast Iron.
1—2 Hutch Pan American 42" Jig.
1—2 Hutch Pan American 18" x 18" Cleanup Jig.
1—International Gas Engine, Model U-2 Power Unit, 19 H.P.
2—30" x 14" Rolls.
1—20" x 12" Rolls.
1—Link Belt Conveyor Tripper for 24" Belt.
1—Link Belt Conveyor Tripper for 20" Belt.
4—52" Merrill Triangular Precipitation Presses. New and Used Parts for 5½' Symons Short Head Crusher.
Miscellaneous Electric Motors, 5 HP to 350 HP. 440 Volts, 3 phase, 60 cycle; 125, 150, and 200 HP., 2,200 volts, 3 phase, 60 cycles.
3—150KV-A Allis-Chalmers Transformers, Type CD; 60 cycle, single phase; voltage rating 23,000-2,300 (with voltage taps); outdoor installation.
3—G.E. Transformers, Type H, Form D M, 60 cycles, single phase. 833 KV-A Continuous—55° C Rise. Voltage Rating 23,000-2300/4000 V.
8800 Ft. 500,000 circular mill stranded: Bare Copper Wire; 13/16" diam. Wt. 1.547±/Ft.
3—Model ±21 Eimco Loaders.
1—G.E. 8-ton Locomotive; without battery.

COMPLETE LIST OF ALL EQUIPMENT WILL BE SENT UPON REQUEST.

GOLDEN CYCLE CORPORATION
P. O. Box 86
COLORADO SPRINGS, COLORADO

AIR COMPRESSORS
9 Electric 5,000, 3,865, 3,178, 2,200, 1578 & 1,302 Ft.
6 Diesel 1,578, 1,000, 676 & 500 Ft.
LOCOMOTIVES AND CRANES
12 Diesel 100, 80, 65, 45, 30, 20 Ton Locomotives.
22 Gas. 35, 25, 16, 12, 8 & 6 Ton Locomotives.
40 Ton Orton Diesel Locomotive Crane.
R. R. CARS
100 Dump Cars, 2, 4, 12, 20 and 30 Yd.
100—60 Ton Flat Cars. 66—50-Ton Gondolas.
150—8,000 & 10,000 Gal. Cap. Tank Cars.
TUNNEL MUCKERS — LOADERS
4 Gardner Denver GD9 & GD14.
10 Eimco 12B & 21, 4 Sullivan HL20.
LARGE JAW CRUSHERS
7—60x84", 40x48", 36x42", 24x36" & 28x36".
ROTARY DRYERS & KILNS
4'x20', 4'x30', 4½'x40', 5'x50', 6'x35', 80"x45', 80"x60', 90"x60', 94"x70' & 104"x85', Single and Double Shell.
Kilns, 4½'x30', 6'x60', 4'x40' & 9'x170'.
150 HP. G.E. Type I Motor, 3-66-2200, 350 R.P.M.
BALL, ROD & TUBE MILLS & CLASSIFIERS
5'x22", 6'x22", 6'x48", 8'x22" & 8"x36" Hardinge Conical Ball Mills.
4x4, 6x6 & 7x5 Cylindrical Ball Mills.
6x14 Hardinge Classifier.
36" & 78" Spiral and 4' Dorr Rake Classifier.
4x10, 5x12, 7x16 Rod Mills, Marcy, Hardinge.
Dings 3-stage 18" Wetherill Mag. Separator.
Oliver Continuous Filters, 8'x12' & 11'6" x 14'.
8'x4' Dorreo Continuous Filters.
STEEL STORAGE TANKS
40—10,000 Gal. R. R. Car Tanks.
PULVERIZERS
6'x48" Hardinge Mill with Air Classifying.
÷0 & ±1 Raymond Automatic Pulverizers.
STANHOPE, 60 E. 42nd St., New York 17, N. Y.

MOTORS, GENERATORS, TRANSFORMERS
1 — 1500 H.P.
Bought and Sold New and Rebuilt
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N. Y.

Rotary Kilns—6½' x 70' & smaller. One 9' x 170'.
Rotary Dryers—3' x 30'—4' x 30'—8' x 40'—5½' x 50'—6½' x 60'—8' x 70'—7' x 80'.
Tube & Ball Mills—6' x 9'—5' x 22'—5½' x 10' 7".
Fuller-Lehigh Mills—22"—42" & 52"—Bradley Mills.
Jaw Crushers—From 10" x 6" up to 38" x 24".
Crushing Rolls—From 16" x 10" up to 72" x 20".
1—Complete Lime Hydrating Plant.
Sturtevant Rotary fine crushers—No. 0—No. 1—No. 1½ and No. 2
Ring Roll Mills—Sturtevant No. 1—No. 2.
15'—16' & 18' Horsechoff furnaces.
Gyratory Crushers, No. 5 and No 12.
8'—14' air separators.
Magnetic separators—jigs—screens—classifiers and thickeners.
5', 6" & 7' dia. Rod Mills.
Mine Hoists.
One 4 roll Raymond Mill, low side.
8' x 10'—8' x 12'—11½' x 18' Rotary Filters.

W. P. HEINEKEN
227 Fulton Street, New York

DRY STORAGE SILO

2700 Barrel, Dry Storage Silo, complete with unloading screw, elevator and discharge gates.

WRITE • WIRE • PHONE

HEAT AND POWER CO.
INCORPORATED
70 Pine St. Digby 8-0373 N.Y.C. 5, N.Y.

✓ CHECK THESE USED BUYS ✓

HOISTS—Reconditioned, Ingersoll-Rand, EUA, Single Drum, air tugger and 20NM2C 2 drum electric slusher hoists.
HOIST—Reconditioned, Lambert, 2 drum shaft with 35 HP motor, 440 volt, 3 phase, 60 cycle, 4565± rope pull, 253 F.P.M.
MUCKERS—Reconditioned, Eimco, Models 12 and 21.
DRIFTERS AND STOPERS—Reconditioned, Ingersoll-Rand, DA30 and DA35, and R-58.
COMPRESSORS & PUMPS—All sizes.
BLOWERS—Reconditioned, Coppus, Models TM-4, TM-5, TM-6.
PUNCHES—Ingersoll-Rand, shank & bit, Model 455P brand new, still in crates.
TRANSFORMERS & ELECTRIC MOTORS—Reconditioned, write for complete list and descriptions.
CLASSIFIERS—Dorr Model DSD, 6' x 23'6", Serial ±1567-D & 954-D.
FEEDER, APRON PAN—6'1" Wide, 22'6" Long, pans 12x40x½". Conveyor 42" wide x 18' long.
GENERATOR—75KW, 250 Volt, D.C., 300 amps, 900 RPM and many smaller generators.
HEATERS—OVERHEAD STEAM TYPE—204,000 to 333,000 B.T.U.'s.
SCREEN—Allis Chalmers, 4' x 8' Vibrating, overhead cable and spring suspension with motor.
WELDER—Reconditioned, Lincoln Arc, 300 Amps, 40 Volt.

CATE EQUIPMENT COMPANY
49 East 9th South
Salt Lake City, Utah Phone 9-2021

350 HP INDUCTION MOTOR

Crocker-Wheeler, 3550 RPM, 3/60/2300 Volts, 76 Amperes, Type SC, Frame B-68-ES, Temperature Rise 40° C. Continuous, Serial No. 1196851. Squirrel Cage. Run only 10 hours, New Condition.

Complete information and detailed specifications on request.

TENNESSEE COPPER COMPANY
61 Broadway, New York 6, N. Y.

FOR SALE

5' Dia. by 4' Lgth. HENDY BALL MILL, STEEL LINERS 90% NEW, FRICTION CLUTCH, V-BELT PULLEY. EXCELLENT CONDITION.

H. T. NEAL MACHINERY CO.
58 Sutter Street San Francisco

WANTED

BUYERS OF SURPLUS COPPER, INSULATED WIRES AND CABLES
No lengths too long or too short.
Telephone: EAstgate 7-4778
PIERCE CABLE CO.
2674 Clybourn Ave., Chicago 20, Ill.

IF THERE IS

Anything you want

that other readers of this paper can supply

OR—

Something you don't want

that other readers can use, advertise it in the

SEARCHLIGHT SECTION

CARLYLE
INDUSTRIAL RUBBER PRODUCTS FOR EVERY PURPOSE

IMMEDIATE DELIVERY OF CONVEYOR, ELEVATOR AND TRANSMISSION BELTING — PIPE, WATER, SUCTION, AIR, STEAM AND WELDING HOSE

WHY WAIT

We have 8 to 48

RUBBER CONVEYOR BELTING

TOUGH COVERS—Heavy duty, specially compounded abrasive resistant rubber covers having high tensile strength. Thoroughly capable of withstanding the abrasive action of bulk materials. Properly vulcanized to the carcass to assure utmost performance, economically.
STRONG CARCASS—Constructed of finest quality 28 and 32 ounce tough cotton duck, properly treated and impregnated to avoid mildew from moisture and atmospheric conditions. Each ply thoroughly embedded in rubber to prevent ply separation.
FLEXIBILITY — Careful attention has been given in the construction of all belts to have the proper flexibility assuring the following desirable features: troughs easily, runs true on all idlers, gouge resistant, excellent for long and short hauls and slope installations.

Avoid delays in your production schedules!

We carry in stock for your immediate requirements, Conveyor Belting in widths from 8 inches to 48 inches.

Width	Ply	Thickness Top Cover	Thickness Bottom Cover	Type of Duck Carcass
8"	4	1/16"	1/32"	28 Oz.
10"	4	1/16"	1/32"	28 Oz.
12"	4	1/16"	1/32"	28 Oz.
14"	4	1/16"	1/32"	28 Oz.
16"	4	1/8"	1/32"	28 Oz.
18"	4	1/8"	1/32"	28 Oz.
20"	4	1/8"	1/32"	28 Oz.
20"	5	1/8"	1/32"	28 Oz.
24"	4	1/8"	1/32"	28 Oz.
24"	5	1/8"	1/32"	28 Oz.
26"	5	1/8"	1/32"	28 Oz.
30"	4	1/8"	1/16"	32 Oz.
30"	5	1/8"	1/16"	32 Oz.
30"	6	1/8"	1/16"	32 Oz.
36"	6	1/8"	1/16"	32 Oz.
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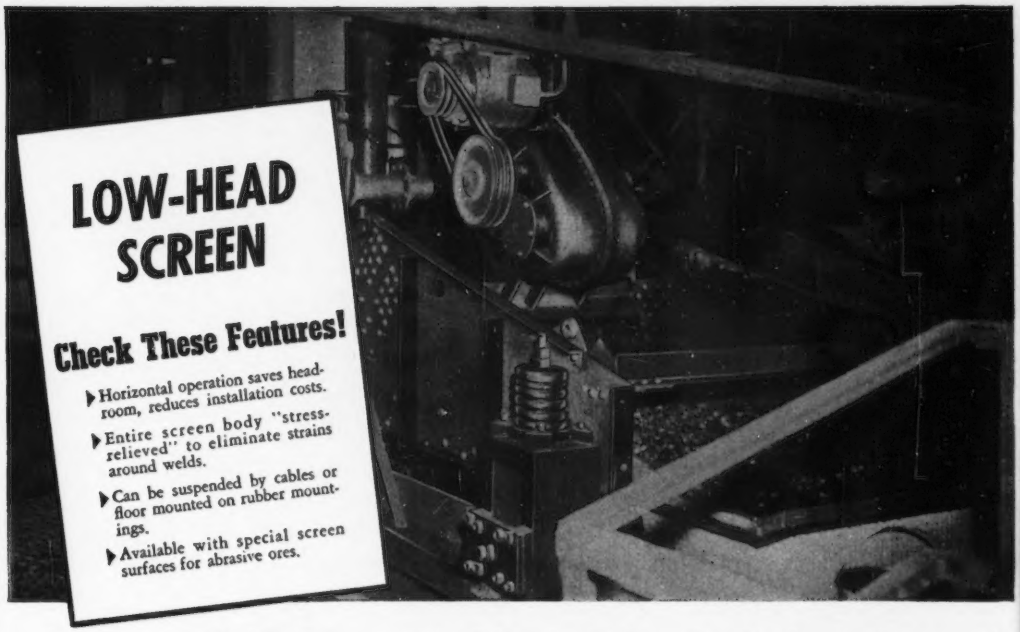
HERE'S PROOF—

Why Allis-Chalmers Sink-Float Screens are Accepted as Standard on Iron Range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The *Low-Head* screen shown above is a typical heavy media screen installation. One of eight *Low-Head* screens installed in the sink-float plant at Holman mines, Taconite, Minn., this 6x16 ft single deck screen is used in the wash and drain process here. It washes media from iron ore concentrate . . . recovers expensive ferro-silicon for re-use.

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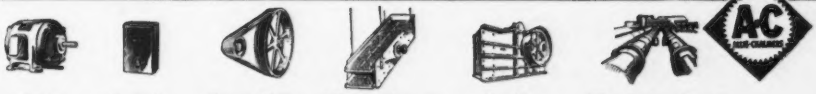

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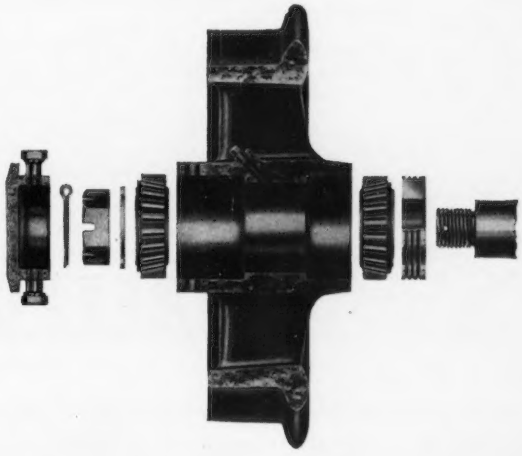

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